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STUART

U.S. Light Tanks in action

squadron/signal publications

ARMOR NO. 18

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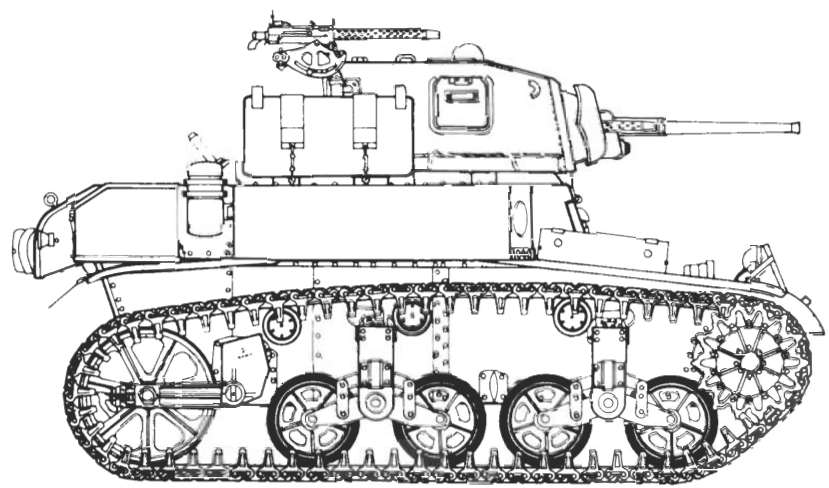
U.S. Light Tanks in action

by Steve Zaloga

illustrated by Don Greer



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(Cover) Two M5 Stuarts of the 70th Independent Tank Battalion take up defensive positions supported by troops of the 2nd Armored Division, near Casablanca, Morocco, 9 November 1942.

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Author's Note

Although there has been a considerable amount written about the use of Lend-Lease American light tanks by the British, particularly in the Desert War, there has been surprisingly little printed on their use by the U.S. Army in World War II. This photo essay focuses on the development and employment of the famous Stuart light tanks and their derivatives from an American perspective. The author would like to pay special thanks to a number of fellow researchers who have generously given aid: Lt. Col. James Loop, Col. Robert J. Icks, D.P. Dyer, David List and especially Bruce Culver, the co-author of this new Squadron/Signal series on American Armored Vehicles.

This book is dedicated to my parents, Muriel and John, for their patient support over the years.

A troop of Light Tank M3 (Diesel)s at the Desert Training Center in Indio, California come under mock attack by a flight of A-20 bombers during maneuvers in September 1942. (US Army)

Prelude To War

At the time of the outbreak of the European War in September 1939, the U.S. Army found itself with fewer tanks than even a small European country like Poland. While the Poles were able to field over 700 armored vehicles during the September Campaign, the U.S. Army had only about 400 worthwhile tanks, if the several hundred worn-out and useless 6-Ton Tanks of World War I vintage are discounted. Even these 400 tanks were of dubious value since virtually all were merely machine gun armed. This lamentable state of affairs can be traced not only to the penurious budgets of an isolationist Congress, but to the absence of a bureaucratic structure within the Army or the Department of War to lobby for funds for tank development and procurement.

Following the conclusion of World War I, the infant Tank Corps was disbanded and tanks were placed under the exclusive control of the Infantry. Many of the more hidebound elements in the Army were irritated at the proposals of the avant-garde theorists who promoted an independent tank force as the army of the future, and like advocates of a separate air force, these visionaries saw their efforts continually frustrated throughout the inter-war period. The Infantry adhered to the conservative doctrine that tanks should be completely subordinated to the walking rifleman and used to flush out machine gun nests and other obstructions in the way of the infantryman's advance. Due to this limited conception, tank development languished. In the 1930s, the Cavalry began to become involved in tank development. The conceptions of some Cavalry officers like Col. Van Voorhis were far broader and more progressive in scope than the Infantry position, and viewed the armored force as essentially a modern, mechanized variant of the Cavalry concerned with the traditional cavalry functions of scouting, pursuit and exploitation. Such views were particularly appealing at a time when the fate of the horse cavalry was in doubt and in 1930 an experimental Mechanized Force was organized at Fort Eustis under Van Voorhis' command. Under the terms of the 1920 National Defense Act, only the Infantry was permitted tanks, so the Cavalry's tanks were labeled "Combat Cars". This promising experiment fell victim to inter-service rivalry and was disbanded in 1931, but the gate was open to further Cavalry development of mechanized units which continued at a slow pace through the 1930s.

The weak support of tank development from small groups of armor adherents in the Infantry and Cavalry was not enough to completely overcome the established service interests of the Army bureaucracy in the scramble for the limited funds available for weapons development and procurement. Tank development received a paltry 5% of the research and development budget earmarked for Army Ground Forces as compared to 50% for the more established Artillery. Light tank development fared much better than medium tank development simply because light tanks were cheaper to design and produce. As a result, the light tank was the mainstay of American tank strength until well into 1942 when medium tanks finally began to enter service in large numbers. The limited conception of the tank held by the Infantry might have led to the technical stagnation of the light tank design if it hadn't been for the Ordnance decision to base both light tanks and combat cars on related automotive designs. The more stringent technical prerequisites of the combat cars led to sounder light tank designs with better speed and automotive performance and greater developmental potential.

There were four basic, related designs in service in 1939 when the European War broke out. The Infantry used two nearly identical types, the Light Tank M2A2 and the M2A3. Both had twin turrets, one armed with a Browning .50 caliber machine gun and the other with a .30 cal. MG. These were supplemented by a .30 cal. in a ball mount in the hull front. The automotively related Combat Cars M1 and M1A1 could be easily distinguished from their Infantry counterparts by their single turrets which mounted both machine guns together rather than in separate turrets and had a somewhat different rear engine deck arrangement. All four types were obsolete by European standards due to their armament, but the basic designs were sound enough to allow both uparming and uparmoring without a serious decrease in performance. In the works

(Above) A tank park of Light Tank M2A2s. The nearest vehicle is missing its .50 caliber main armament in the port turret which has been removed for cleaning. These vehicles were popularly called "Mae Wests" by tank troops for their twin turret design. The playing card markings on the turret sides designated companies while the number signified the individual vehicle. (National Archives)
(Below) A company of M2A3s and M2A2 (second vehicle) on the march during 1939 maneuvers. The M2A3 and late production M2A2s had slab-sided welded turrets while those on the earlier M2A2 were round. (National Archives)

was a new design which incorporated the hull and chassis of the M2A3, but like the Cavalry tanks, was fitted with a single turret. The new tank was armed with the new 37mm M5 anti-tank gun which was then entering service as the standard U.S. Army anti-tank weapon. The new type was designated Light Tank M2A4 and the first service model rolled out of the American Car & Foundry factory in May 1940. Production continued until March 1941 and amounted to 365 vehicles. The Baldwin Locomotive Works produced 10 more in April 1942. The M2A4 was a key transition from the light tanks of the pre-war years to the light tanks that would serve in the U.S. Army during the war years.

The successes of the German Blitzkrieg in Poland emboldened American tank force adherents and threw new life into their efforts to secure more autonomy and equipment for the existing armored units. While the victories of the Panzer Divisions in Poland could be disdainfully belittled because of the backward state of the Polish Army, the stunning victory over the French and British in May and June 1940 could not be ignored even by the most conservative Army officers. The successes of the 7th Calvalry Brigade (Mechanized) in the 1939 Army maneuvers in the Champlain Valley were impressive but the devastating results of Col. Chaffee's ad hoc armored division in the Louisiana maneuvers of 1940 left the Army with only one plausible direction to turn. Chaffee's 7th Cavalry Brigade had formed the core of the improvised unit, to which was added the 6th Infantry (Motorized) and Maj. Bruce Magruder's Provisional Tank Brigade (which was equipped in part with the new M2A4). The unit dominated the war game and on 10 July 1940, the Armored Force was created at Fort Knox with now Brig. Gen. Adna Chaffee in command. On 15 July, the 1st and 2nd Armored Divisions were activated, the first of 16 armored divisions to be formed during the course of WW II.

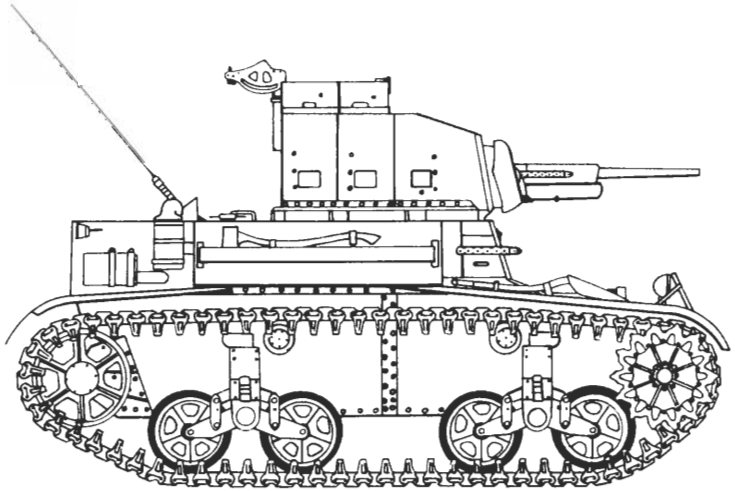
The defeat of France and the creation of the new armored divisions provided a vital impetus to the technical development of light tanks. Special emphasis was placed on light tank production since it was evident that an adequate medium tank design was at least a year off, and in the meantime, there was a great need for tanks to train the new armored formations and to supply the needs of Lend-Lease recipients.

(Above) A Combat Car M1 of the 1st Cavalry Regiment (Mechanized) at Fort Knox in 1939. Unlike the infantry tanks, the combat cars had their main armament in a single turret. (National Archives) (Below) A formation from the 13th Cavalry Regiment (Mech.) of Chaffee's 7th Mechanized Cavalry Brigade at the 1939 war games in the Champlain Valley. In the foreground are a pair of Scout Car M3s, behind them a single M1A1 (W 40113) and a large number of Combat Car M1s. (National Archives)

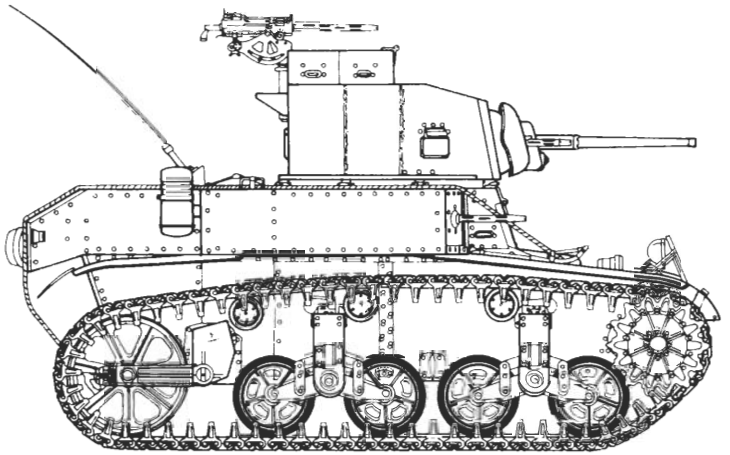
A Light Tank M2A3 belonging to the 68th Infantry Tank Regiment of Col. Bruce Magruder's Provisional Tank Brigade at Fort Benning in 1939. These Mae Wests remained in service for training until 1942. (National Archives)

A pair of brand new Light Tank M2A4s on invasion maneuvers on the California coast in 1941. Note that the machine guns are missing from both vehicles. (National Archives)

Stuart Development



M2A4



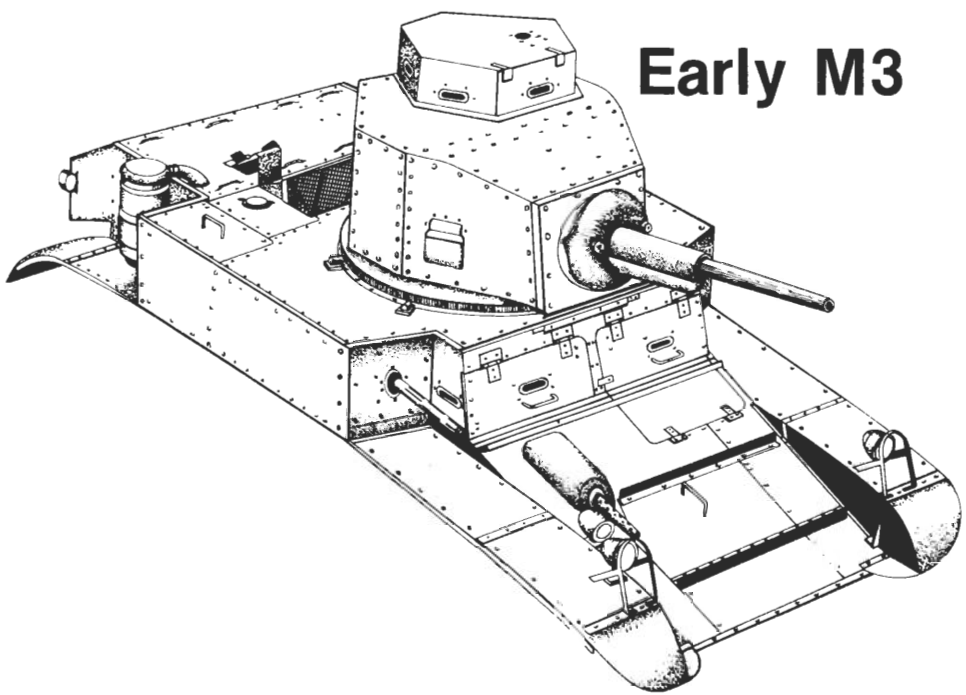
M3

An M2A4 of the 68th Tank Regiment, Company F of Col. Magruder's Provisional Tank Brigade, during the 1940 Louisiana maneuvers. The smashing successes of this unit and Chaffee's 7th Cavalry Brigade during the war games led to the formation of the Armored Force shortly afterwards. (National Archives)

The Light Tank M3

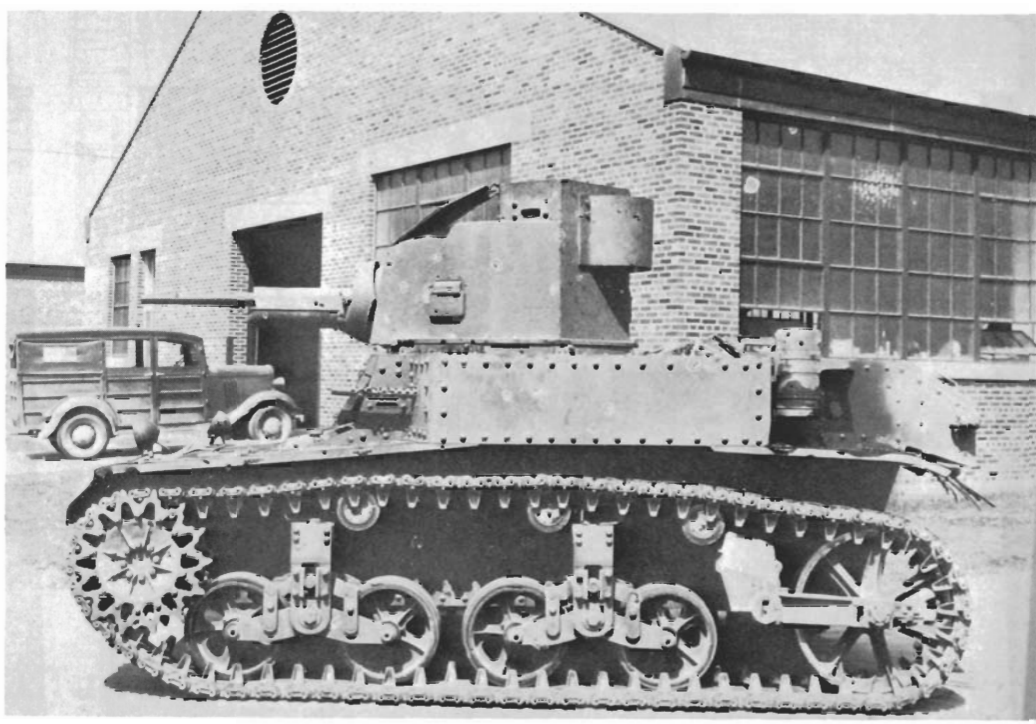
The M2A4 was clearly a transitory type to bridge the gap between the machine gun armed types of the 1930s and the new designs necessary to survive on the European battlefields of the 1940s. The Ordnance Committee in June 1940 recommended that the new light tank be uparmored to 1½ inches on the frontal surfaces and in July directed that this uparmored and otherwise improved vehicle be designated the Light Tank M3. The new M3 design in fact incorporated numerous improvements over the older M2A4. The turret of the M3 was identical in shape with that of the M2A4, but the primitive view slots on the turret sides were replaced by improved types. The M2A4 had been fitted with the M20 mount which left a considerable part of the vulnerable gun recuperator exposed outside of the turret. On the M3, this was replaced by the improved M22 mount which used the same 37mm gun, but contained the recuperator assembly inside the turret. On the hull, the most noticeable changes occured in the rear of the vehicle. The mufflers were moved under a newly added armored overhang which served also to protect the vulnerable rear engine area as well as to hide any backfire flash from enemy observation. In order to support the extra armor, a new trailing idler was added which increased track ground contact to better distribute the added weight. The first M3 left American Car & Foundry in March 1941, and some of the early machines still carried the old M20 gun mount while awaiting production of the new mount.

During the production of the 5,811 M3 Light Tanks built up to August 1942, there were numerous mechanical and technical changes in the design. While the tank's designation remained unchanged, the final production types were considerably different in appearance from the early machines. One change that took place almost immediately was the substitution of a new welded turret for the older riveted turret. This was done to conserve weight and to protect the crew from the threat of rivet heads flying about the inside of the turret should the armor be struck by a projectile. Tests beginning in 1938 at Aberdeen Proving Grounds (APG) had led Ordnance to begin developing welding methods to completely replace riveting in all tank designs and their findings were borne out by the experiences of M3 crews in the Philippines in 1942. The second major technical change was the development of an M3 variant powered by the T 1020-4 Guiberson radial diesel engine. The original M3 had been powered by the Continental W 670-9A gasoline radial engine and it was feared that increased defense requirements for aircraft powered by this engine might lead to a shortage. As a result, M3s were produced concurrently with the Guiberson and Continental engines. The Guiberson variant was designated Light Tank M3 (Diesel) and can be distinguished by the longer exhaust pipe on the engine deck which on this variant fed directly into the engine's manifold, entering the hull through the screening above the crankcase. For a short period, the Armored Force was considering powering all tanks with diesels but eventually returned to gasoline engines when it was realized that diesel powered tanks in an Army equipped entirely with gasoline powered support vehicles would cause unnecessary logistical problems. American Car and Foundry continued to produce both variants, but nearly all Guiberson engined M3s were kept in the continental U.S. for training purposes. A total of 1,285 M3s were diesel powered.

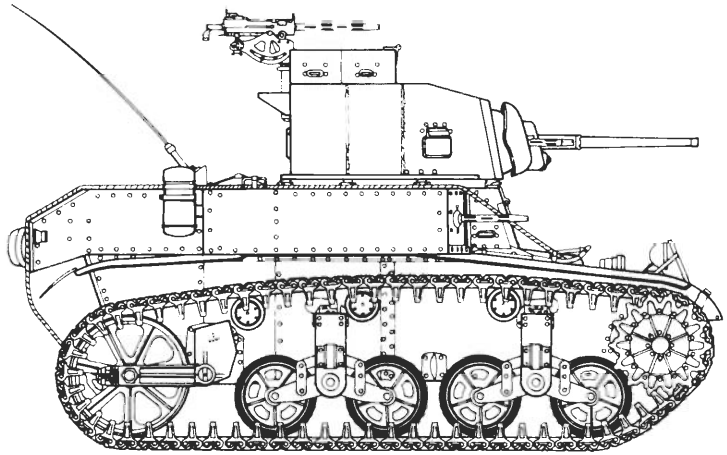


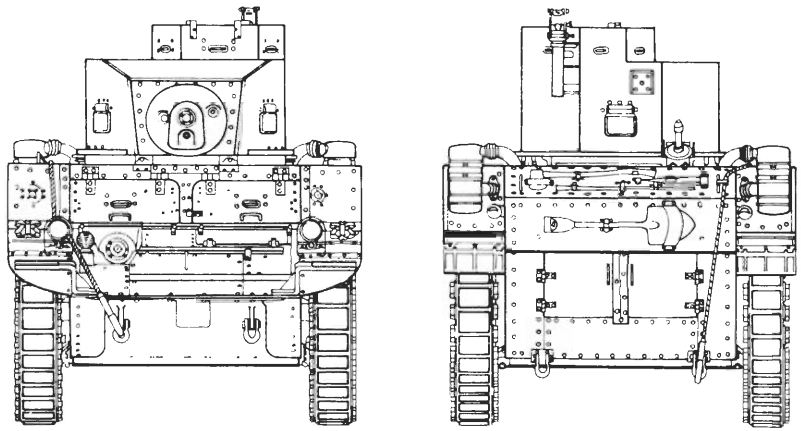
Early M3

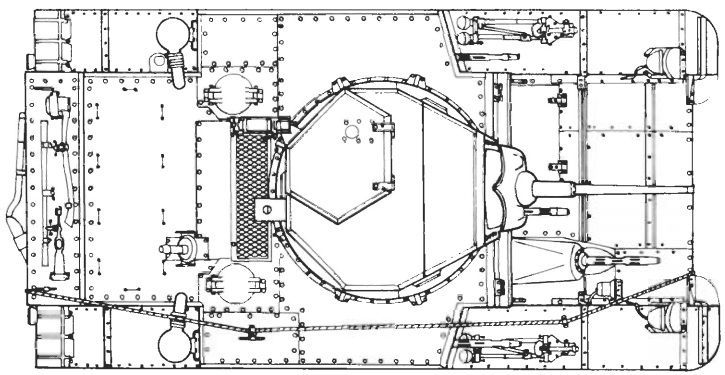
An M3 which was used in tests at Aberdeen Proving Ground to determine whether machine gun damage would cause rivets to fly off on the inside of the vehicle is seen here. There was a shortage of M22 gun mounts in 1941 and this vehicle is fitted with an old M20 mount from an M2A4. The sheet metal protrusion at the turret rear was used to protect the machine gun anti-aircraft mount. (National Archives)



Light Tank M3

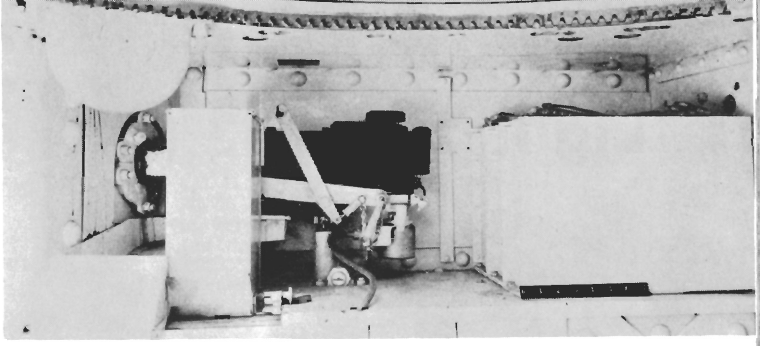






The next set of improvements were rather minor. The fuel caps on the engine deck were given armored covers and the crude vision slots on the hull front were protected by new prismatic protectoscope covers. In March 1941, Ordnance authorized the design of a new turret formed out of homogenous armor plate with new protectoscope fittings and this entered production with tank No. 1946. This new turret is easily distinguishable from the earlier riveted and welded face hardened armor turrets due to its distinctive round appearance which resembled a horseshoe when viewed from above. At about the same time, vehicles were provided with track grousers for use in the event of poor road conditions and these were stowed in a new box at the rear of the vehicle. The last major addition to the M3 was the provision for a gun stabilizer which was intended to keep the gun on target while the vehicle was on the move. The early gyrostabilizers were fairly simple and not popular with the crews. All of these changes were introduced gradually to prevent an interruption in the flow of equipment from the factory. By 1942, American Car and Foundry was producing more tanks in one month than had been produced in all factories from 1930 to 1940.

A Light Tank M3 of an unidentified cavalry regiment at Camp Funston in March 1942. This vehicle is from the early production batch which was fitted with the riveted turret. Note that it still is fitted with the early unarmored fuel caps on the rear deck and is Continental powered, indicated by the short intake hoses leading from the air cleaners. (US Army)

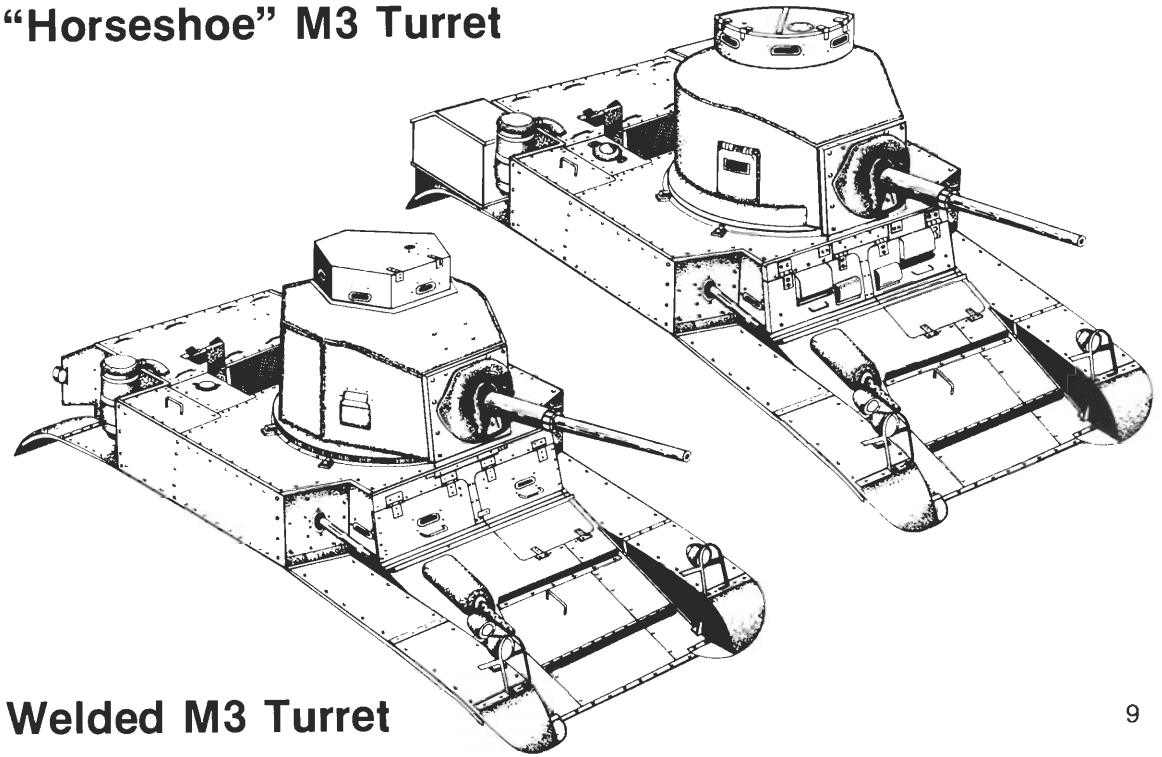


This interior view shows the mounting within the starboard sponson for the Browning .30 cal. machine gun. These sponson guns proved impractical in combat and were often removed in favor of more stowage space. (National Archives)

One of the first batches of M3s with welded turrets, here being used for training in 1941. Note that some of the tanks still do not have their main 37mm gun. (National Archives)

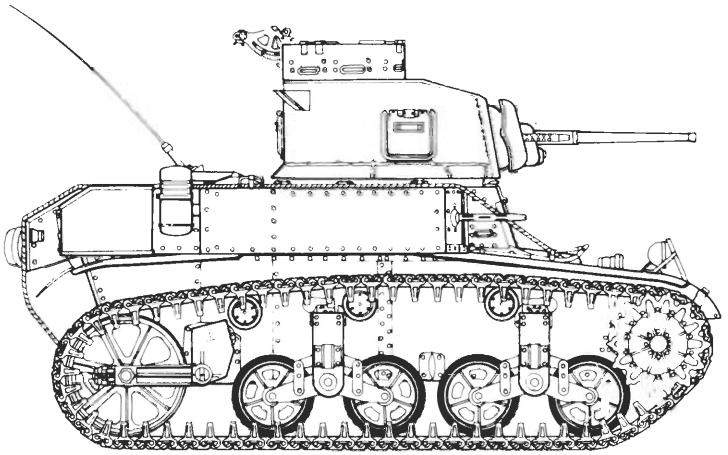
(Below Left) An M3 (Diesel) with welded turret of the 80th Armored Regt. under simulated gas attack at Fort Knox in 1942. The vehicle is fully armed and marked with the standard Armored Force band. (US Army)

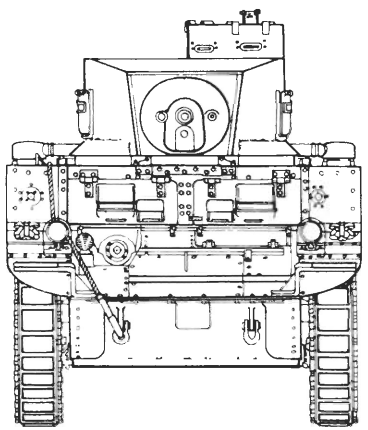
"Horseshoe" M3 Turret

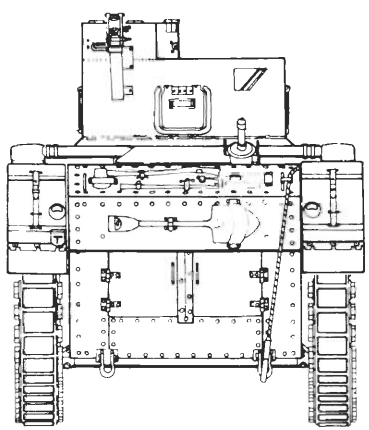


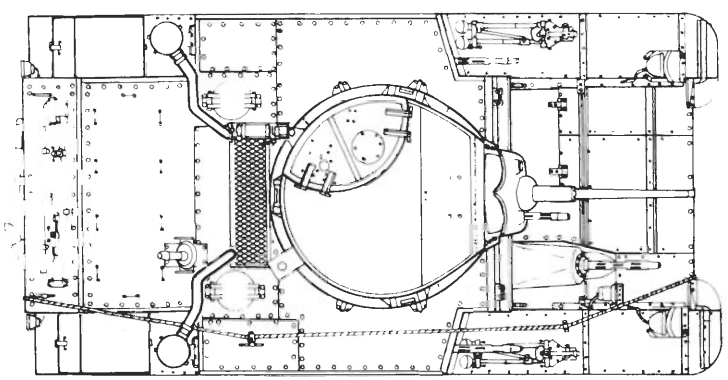
Welded M3 Turret

Light Tank M3 (Diesel)

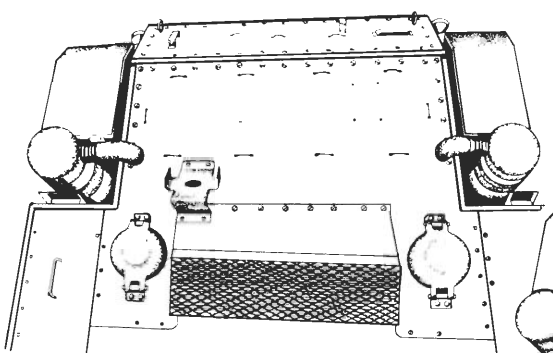




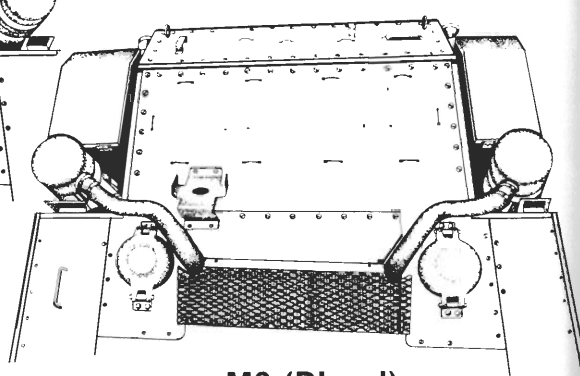




A new M3 with the round, horseshoe turret shows its paces on the test track at Fort Chaffee, Ark. This is a standard production M3 with the horseshoe turret and grouser stowage boxes. This particular vehicle is not fitted with the sponson MGs. (US Army)



M3



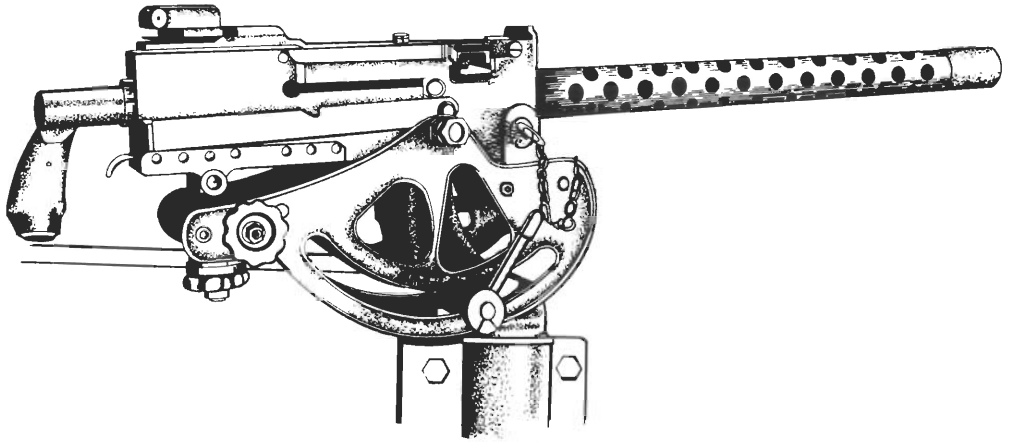
M3 (Diesel)

Muffler arrangement

An M3 at Indio, Cal. shows the protectoscope fitted to the front hatches of most M3s produced after 1941. (US Army)

An M3(Diesel) of the same unit during maneuvers in 1942. At that time, the Armored Force switched to yellow national insignia to reduce contrast, as shown here. A vehicle named, "Dot Dot Dot Dash" (Morse Code for V), is barely visible in yellow on the hull side. (US Army)

M20 Mount with M1919 .30 cal MG



Company C of the 70th Tank Battalion, training on M3s in Iceland in 1942. (US Army)

The Stuarts Enter Combat

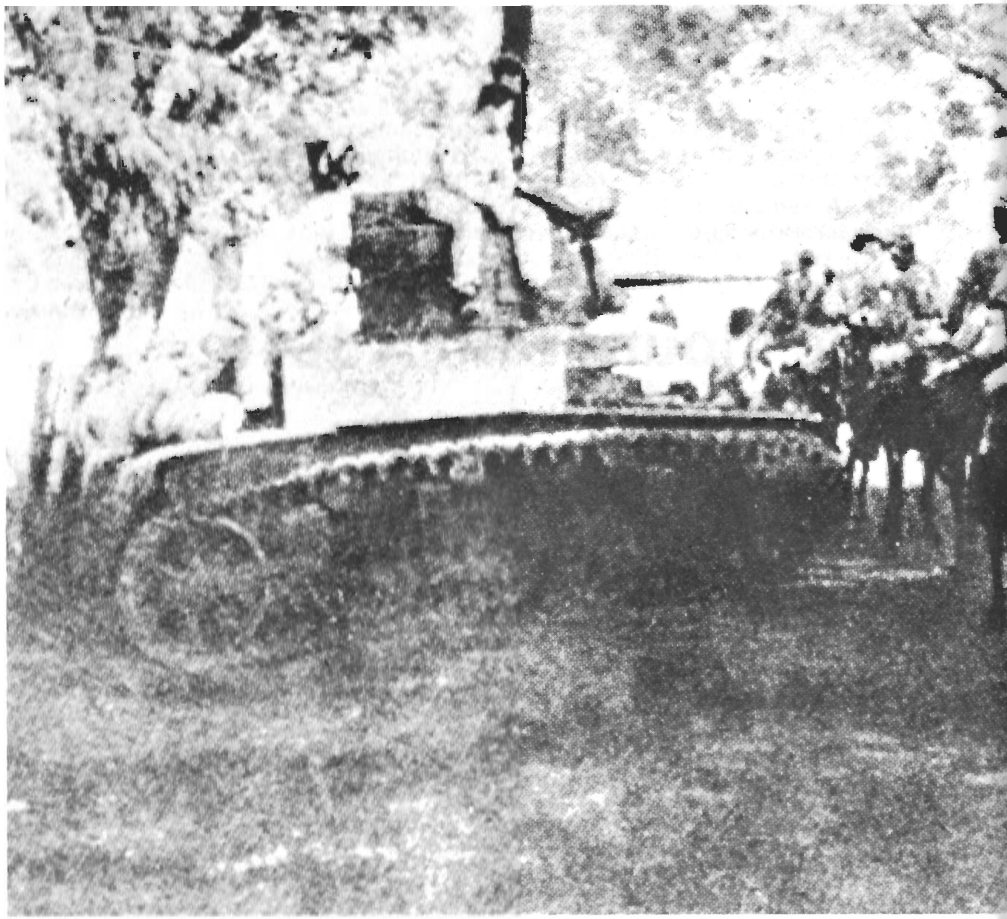
The terrible attrition of the tank battles in the North African desert left the British 8th Army sorely in need of tanks. Churchill personally intervened with Roosevelt to expedite the shipment of any available tanks to the Desert Army and as a result much of the early M3 light tank production was earmarked for the British. The first batch of 84 M3s arrived in Suez in July 1941 and were used to equip the badly depleted 8th King's Royal Irish Hussars who had been engaged in the successful actions against the Italian Army during the preceding winter. The British officially designated this new tank "General Stuart" after the famous cavalry general of the Confederate Army in the Civil War, and the name stuck to the whole family of M3-M5 light tanks. The British crews took an immediate liking to the vehicle and nicknamed them Honeys for their pleasant handling characteristics. However, the British were not as happy with the 37mm gun which was less effective than their own 2 pounder (40mm) but this was somewhat offset by the vehicle's reliability. Subsequent shipments of Stuarts went to equip the other regiments of the British 4th Armoured Brigade - the 3rd RTR and the 5th RTR. After orientation training, the Bridage was brought forward to participate in Operation Crusader. The 4th Armoured Brigade first saw action with its new mounts on 18 November 1941 near Gabr Saleh when it encountered Panzer Regiment 5. In the ensuing skirmish, 11 Stuarts and 7 German tanks were lost. The Brigade saw action until the middle of December when it was withdrawn to Egypt. The unit's commander, Brigadier Gatehouse, reported to American technical advisers that the Honey had far exceeded the fondest expectations of the British. Of the Brigade's 166 Stuarts, only 12 had been lost owing to mechanical failure. To the British, used to the mechanical crankiness of their own vehicles, this was just short of a miracle.

The most serious drawback of the Stuart, aside from its small gun, was its limited cruising range of only 75 miles which was a serious handicap in desert action. The stiff vertical volute suspension was found to bounce the crew around rather badly and interior padding was sorely lacking. Both suggestions were taken to heart and corrections were incorporated on subsequent production vehicles. The British made a number of modifications on their own Stuarts in the desert. The sponson guns were removed and the resulting space was used for additional stowage. Sand shields were added to cut down the amount of dust kicked up, and various boxes and racks were welded on for stowage. The Stuart served with many other Armoured Brigades in the desert as more became available through Lend Lease, but as 1942 progressed, M3s were becoming increasingly obsolete. The Desert Theatre was beginning to feel the effect of the technological arms race spurred on by the combat introduction of the T-34 by the Soviet Army in the summer of 1941. New versions of the Pz. III and Pz. IV were appearing with thicker armor and longer guns. Fortunately for the British, the new Medium Tank M3 Grant appeared in time for the Gazala battles in May 1942. Subsequently, the Armoured Regiments had their Stuart formations stiffened with the more potent Grants. After the summer of 1942 when mediums became available in greater numbers, the British began increasingly to relegate the Stuarts to scouting roles.

The Americans were to learn the lessons of the desert the hard way. With the employment of Stuarts by the 1st and 2nd Armored Divisions in Tunisia in 1943, the United States began to fully appreciate, in particular, the inadequacy of the 37mm gun. Shortly after the first engagement of the Stuarts at Gabr Saleh, the first American unit to see action in the M3 was formed. In September and November 1941, two ships left San Francisco carrying the men and 108 M3 tanks of the 192nd and 194th Tank Battalions. On 19 November, both units were joined, along with the 17th Ordnance Company, to form the Provisional Tank Group under Brig. Gen. James Weaver to serve in the defense of the Philippines. Both units had been formed from National Guard Tank Companies and neither group had ever seen an M3 before they embarked. Each battalion had 54 M3 tanks, but their allotment of half-tracks and support vehicles was far understrength. On inspection it was found that there was no high explosive ammunition for the guns, no oil for the guns' recuperators and no tank radios. Not until after the war began were the tank guns able to be fired, and when the radios arrived they proved to be the wrong type. As a result of the radio mix-up, the machine gun in the right sponson had to be removed to make room for the new set. This left a hole in the front armor that local Ordnance refused to cover over in the absence of written orders from stateside. Like so many other matters, this had to be resolved by extraordinary means.

On 8 December, the tanks of Company D of the 194th Tank Battalion were stationed around the perimeter of Clark Field in anti-paratroop positions. During the

A poor, but rare shot of an M3 of the 192nd Tank Battalion supporting the 26th Cavalry Regiment (PS) near Pozrrubio in the Philippines on 10 Dec. 1941. (Author)



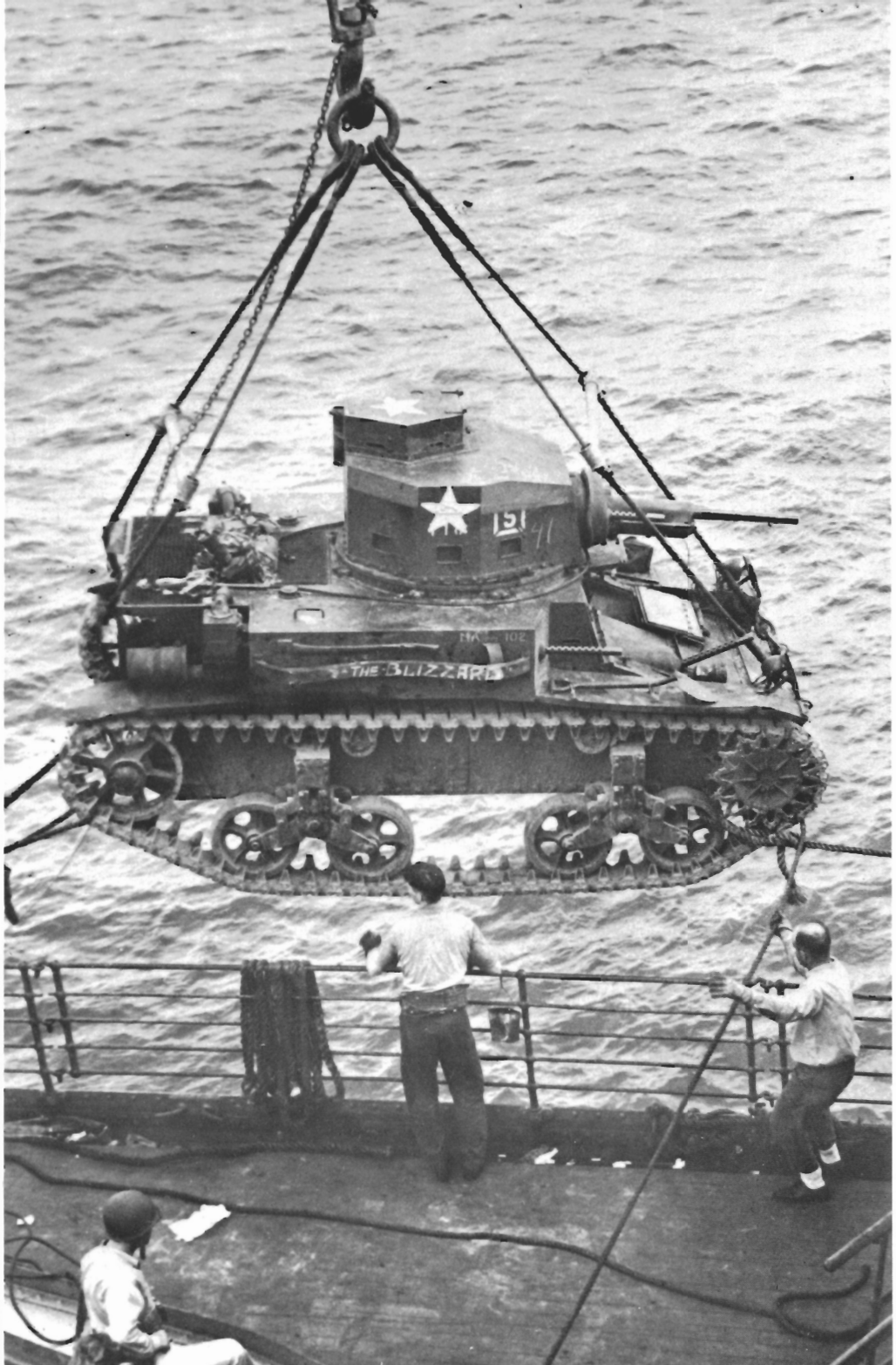
Japanese air raids, the tanks brought down one fighter which was later matched by the 192nd Tank Battalion. The 192nd Tank Battalion was eventually assigned to assist in repulsing the Japanese amphibious invasion at Lingayen Gulf and in the first tank-vs-tank engagement of the U.S. Army in World War II, met tanks of the Japanese 4th Sensha Rentai around Damortis on 22 December 1941. A small scouting patrol of 5 tanks from Company C was sent down a narrow jungle road where it ran into a group of Type 95 Ha-Gos which had prepared an ambush. The lead tank was destroyed and the remaining 4 tanks all hit, but managed to escape. The 192nd Tank Battalion was forced to withdraw with the rest of the Army, but remained in contact with its adversaries in the 4th Sensha Rentai, fighting another battle outside Moncada on 27 December without result. Company C finally got revenge on 31 December 1941 around Baluag. That day, the Japanese had captured the town, and the Company, now under Lt. Wm. Gentry, was ordered to dislodge them. Around 1700, the M3s barreled into the town, shooting the place up and making a general shambles of things. They soon ran into Ha-Gos of the 4th Sensha Rentai and in the fading light, American and Japanese tanks began chasing each other through the narrow streets. By nightfall, the M3s had knocked out 8 Type 95s at no cost to themselves.

During the subsequent months of action during the retreat towards Bataan, there were few other tank-vs-tank engagements and the Provisional Tank Group was used mainly in desperate rear guard actions. These skirmishes were extremely costly in men and equipment and many tanks had to be left behind when bridges were prematurely blown up by other retreating units. This was such a problem that by 20 February 1942 the Japanese had captured 31 M3s. In the later phases of the fight, the M3s served alongside M3 Gun Motor Carriages (M3 half-tracks fitted with a 75mm anti-tank gun). The last tank action of the campaign occurred on 7 April 1942 when the tanks of the 194th Tank Battalion destroyed two enemy tanks, probably of the 7th Sensha Rentai. The 194th Tank Battalion was the last American unit to withdraw into Bataan and saw action until the end of the campaign at which point all remaining equipment was destroyed. Many of the crews subsequently died in the infamous Bataan Death March. Several of the M3s that had been captured by the Japanese were sent home for evaluation, but the rest were used in the Philippines by the 3rd Chutai of the 7th Sensha Rentai for garrison duty. During the fighting in the Philippines in January and February 1945, some of these Stuarts were used against the Americans, being captured or destroyed. Ironically, these Stuarts were the first and last M3s to see action in the Pacific.

Subsequently, a small number of M3 Stuarts of the late production type with round turrets were used by the 1st and 2nd Armored Divisions in Tunisia and by B Company of the 1st Marine Tank Battalion on Guadalcanal. But by 1942, the M3 had largely been replaced by the M3A1 or the M5 Light Tank and those remaining were kept in the continental United States for training.

Aside from Ordnance designed light tanks like the M3, some other American manufactured light tanks saw combat in the early days of the Pacific War. The Marmon-Harrington Company, world famous for their agricultural tractors, was approached by the Dutch government to build light tanks for the Army of the Dutch East Indies (KNIL). The KNIL eventually ordered 600 Marmon-Harrington tanks consisting of 200 each of the CTLS-4TAC and CTLS-5TAC and 100 each of the CTMS-1 TB1 and MTLS-1 G14. They were intended for 6 Brigades, each with a battalion of 90 tanks. The CTLS models were some of the most bizarre of American pre-war tank designs and the -4TAC and -5TAC were mirror images of one another, one with the turret offset to the right and the other with the turret offset to the left. Only 25 arrived in Java before the collapse. A further 28 of the CTLSs, 26 CTMSs and 20 of the MTLSs arrived in Surinam where they were used by the Dutch Marines. The remainder of the contract was taken over by the United States, some of the CTLS machine gun tanks being designated T14 and T16 and seeing action during the retaking of Kiska and Attu in the Aleutians. The remainder were put up for sale through Lend-Lease and most eventually made their way to Lend-Lease recipients in Central and South America. A British tank designer assigned to Lend-Lease liaison took one look at them and immediately pronounced them 'ghastly'.

A rare shot of a group of Stuarts captured during the fighting in the Philippines in 1942 from the Provisional Tank Group and being used here on parade in May 1943 by the 3rd Chutai of the 7th Sensha Rentai. (Paul Whelan)



A T14 of the Provisional Tank Company of the 138th Infantry at Umnak Island in the Aleutians in 1942. (US Army)

(Left) An M2A4 destined for Guadalcanal is lifted into a landing craft. This view clearly shows the numerous detail differences between the M2A4 and the M3. In particular note the gun mount, the road wheel spacing, the raised idler and the early style rear deck. Reflecting the cavalry tradition of US tank units between the wars, this tank still carries a crossed sabres plaque, covered by the crude, hand-painted star. The only combat use of the M2A4 was at Guadalcanal. (US Navy)

A column of M2A4s and M3s of the 1st Marine Tank Battalion on Guadalcanal in late 1942. The lead vehicle is an M2A4. (US Navy)

A T14 and T16 behind it showing the similarity of these two designs. (US Army)

(Left) An Australian M3 during the fighting in New Guinea in May 1943, fitted with a peculiar, enlarged turret ring to prevent mud from fouling the turret race. Note the sponson MGs have been removed and the ports blanked over, standard Commonwealth practice with M3s. (US Army)

(Right) One of the survivors of the heavy fighting in Tunisia, December 1942. This M3 of the 13th Armored Regiment is stationed outside of Maknassy in January 1943. A name, it looks like "Equalizer", has been added to the hull side. Note also the grouser stowage on the glacis plate. This may have been an effort to add to frontal protection, because the vehicle retains the stowage boxes in the rear. (US Army)

The Light Tank M3A1

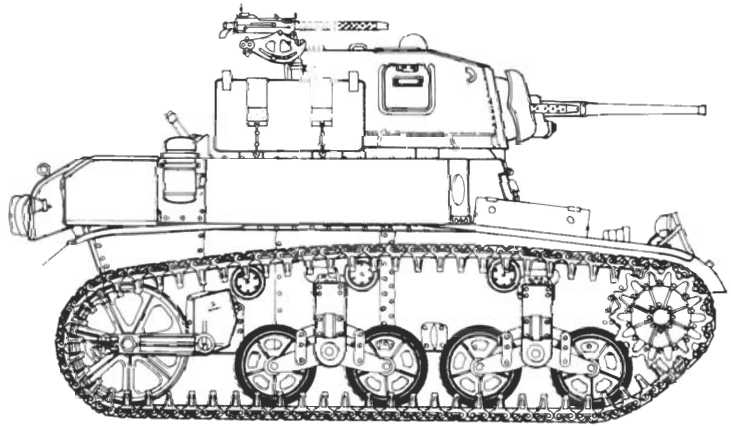
The M3A1 was the first Stuart variant to benefit from the expanded war time testing of Ordnance and would eventually incorporate many of the features recommended by the British after their desert experience with the M3 series. It differed from the M3 principally in the area of its improved turret which had been undergoing study since the spring of 1941. Tests using the new gyrostabilizer already fitted to the M3 tank found that accuracy was considerably improved when an Oil Gear traversing motor was used instead of the manual traversing gear. The problem with fitting such a device to the M3 was that the existing fighting compartment design was not suited to the fast traverse of the new motor. Crew members in the turret had a hard time moving around because of the presence of the drive train which ran through the fighting compartment to the transmission in front. The obvious solution was to provide a turret basket in which the gunner and commander could sit. The pilot model with these improvements was built using the horseshoe M3 turret, but because the designers wanted to add a turret periscope, the production models had the cupola removed. The turret periscope was linked to the gun telescope and 37mm main gun. The modified mount was designated M23. In the absence of the large cupola, another hatch was added to the right side of the roof, and a second periscope was added to compensate for the loss of the cupola view slits. The rearrangement of the turret interior mandated by the new turret basket led also to the repositioning of the exterior pistol ports. The new Stuart with all of the improvements was designated Light Tank M3A1 and entered production in July 1942.

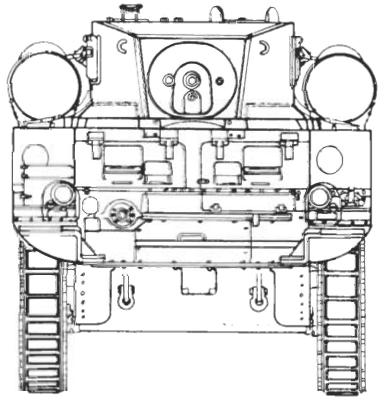
A number of further modifications were added during the course of M3A1 production. To increase the range of the Stuart as recommended by the British, two jettisonable fuel tanks were fitted to the rear deck. These were mounted on inclined brackets so that by pulling a cable release from inside the vehicle, they could be jettisoned before entering combat. Each tank contained 25 gallons and effectively doubled the Stuart's range. Internal padding was provided to cushion the crews from rough rides and the rather useless sponson machine guns were eventually removed and the space used for additional stowage. In summer 1942, vehicles were produced with a partially welded hull. All exposed side surfaces were welded, rather than riveted, to the internal frame to minimize rivet splash. A total of 211 M3A1s were produced with the Guiberson diesel before the Armored Force decision to adopt only gasoline powered tanks, and the other 4,410 M3A1s were powered by the usual Continental radials. Production ceased in February 1943. The M3A1 was regarded as an expedient design by Ordnance until a new design better suited to the turret basket arrangement could be built. The M3A2 designation was retained for a version with an entirely welded homogenous armor hull, but the project was dropped when the go-ahead was given for the M3A3.

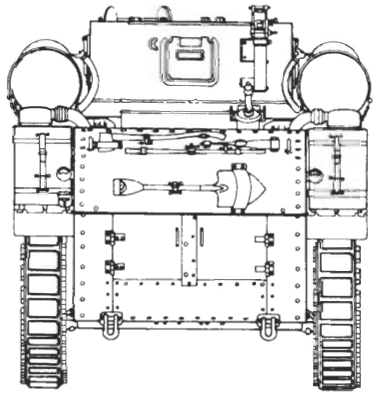
An M3A1 (Diesel) of Company C, 1st Marine Tank Battalion on Guadalcanal in 1942. This was one of the few diesel powered tanks to ever see combat and is from the early production batch with riveted hull. Note the early Marine Corps serial number painted over the blue drab Army serial on the hull side. (US Navy)

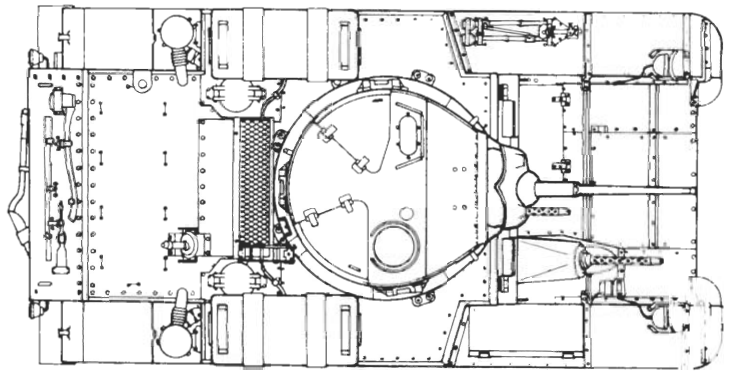
"Tiger", an M3A1 of the 3rd Platoon, Company C, 1st Battalion, 1st Armored Regiment, 1st Armored Division, is seen here disabled in Tunisia in early December 1943. The vehicle still carries the 25 gal. spare fuel tanks on the back. This has the partially welded hull. Note the yellow markings. (Bundesarchiv)

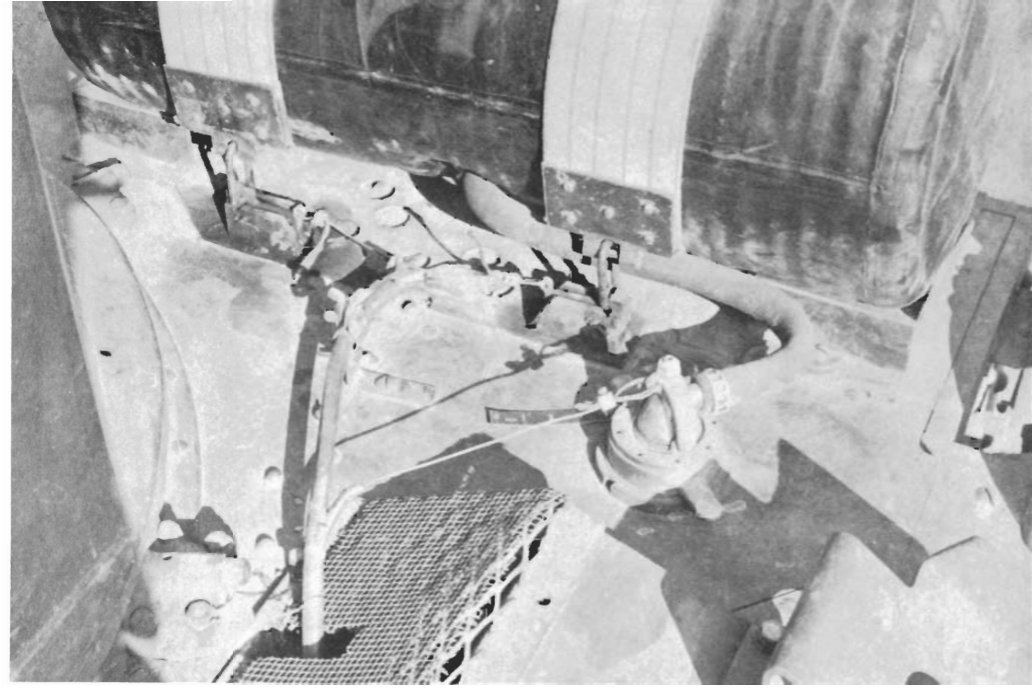
Light Tank M3A1



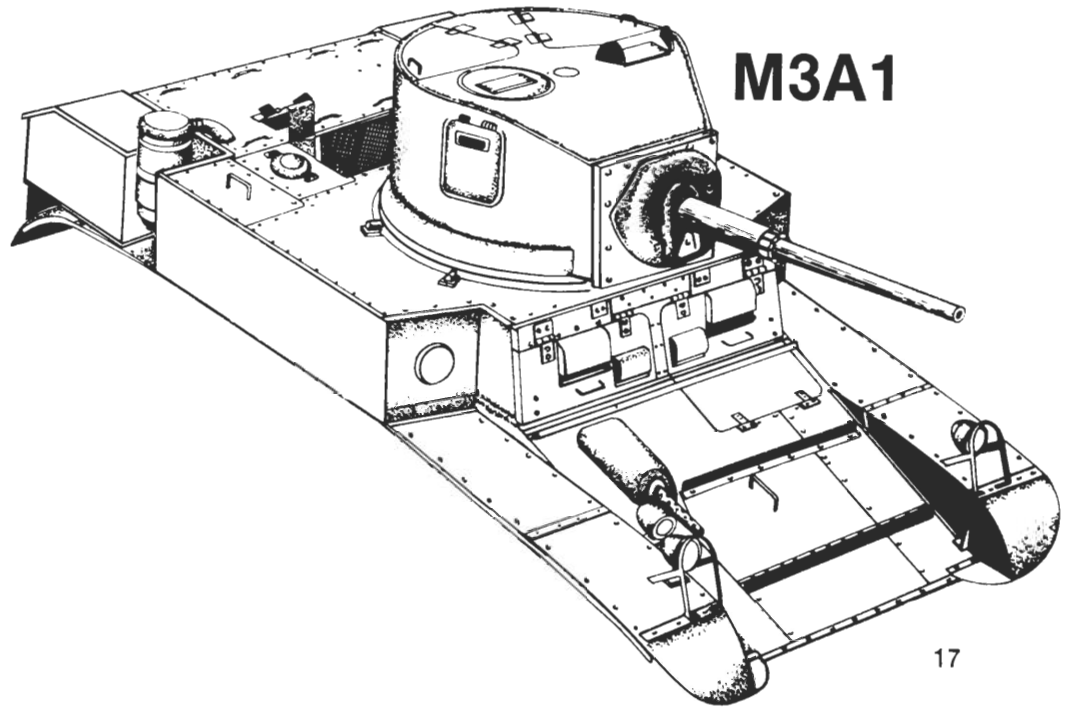








This photo shows the mount for the jettisonable fuel tanks in locked position. These tanks effectively doubled the range of the Stuart to about 150 miles. Pulling the cable from inside the vehicle unlocked the retaining straps. (National Archives)



Three of the eight M3A1s of the Marine 9th Defense Battalion patrol around the Munda airstrip on 6 August 1943. These Stuarts have had metal plates welded over the lightening holes on the road wheels to prevent the Japanese from jamming metal or wooden beams into them, thereby jamming the running gear. The front and fenders have been removed and sponson MGs deleted. (US Army)

The Light Tank M3A1 In Combat

The combat debut of the Light Tank M3A1 was with the 1st Marine Tank Battalion on Guadalcanal in September 1942. This battalion received a hodge-podge assortment of light tanks from the Army before sailing. These included obsolete M2A4s (Company A), M3s (Company B) and the new M3A1 (Diesel) (Company C). These were among the only diesel powered Stuarts to see action. The M3A1s saw bloody fighting in the jungles of Guadalcanal, being used mainly to wipe out strongpoints in support of the Marine drives and to repulse infantry attacks with their deadly canister rounds. The M3A1 was the principal tank type used by the Marine Tank Battalions until well into 1944 when Shermans and M5A1s finally became available. It served with such units as the 2nd Tank Battalion on Tulagi, the 9th Defense Battalion at Munda, the 10th Defense Battalion in the New Georgia Campaign, and the 11th Defense Battalion at Arundel.

The most extensive use of the M3A1 by American troops came during the North Africa campaign in the fall and winter of 1942-43. The 1st and 2nd Armored Divisions were committed to the invasion of French Morocco and at the time each division consisted of two tank regiments, each regiment equipped with two medium tank battalions and one light tank battalion. The two light tank battalions of the 2nd Armored Division were equipped with the brand new Light Tank M5, while the two battalions of the 1st Armored Division, which would bear the brunt of the fighting, were equipped mainly with Light Tank M3A1s and a small number of M3s.

During the landings of the 1st Armored Division at Oran, the tank lighters were too small to carry many Medium Tank M3 Grants, and as a result, the Light Tank Battalions of the 1st and 13th Armored Regiments were landed first. On 8 November, Col. Water's 1st Battalion, 1st Armored Regiment was sent to seize the Tafaraoui airdrome while Col. Todd's 1st Battalion, 13th Armored Regiment was assigned the La Senia airstrip. It was important to control the airfields to prevent the Vichy French Air Force from interfering in the landing operations in the harbor. On 9 November, Col. Todd's Battalion pushed past a few French roadblocks after destroying some antiquated White AM armored cars at Bou Tlelis, and captured the La Senia field. Aerial reconnaissance that day revealed a mechanized relief column heading from the Foreign Legion post at Sidi-bel-Abbes. After American Spitfires had strafed it, Col. Water's battalion, which had captured the Tafaraoui field the previous day, was ordered to intercept and destroy.

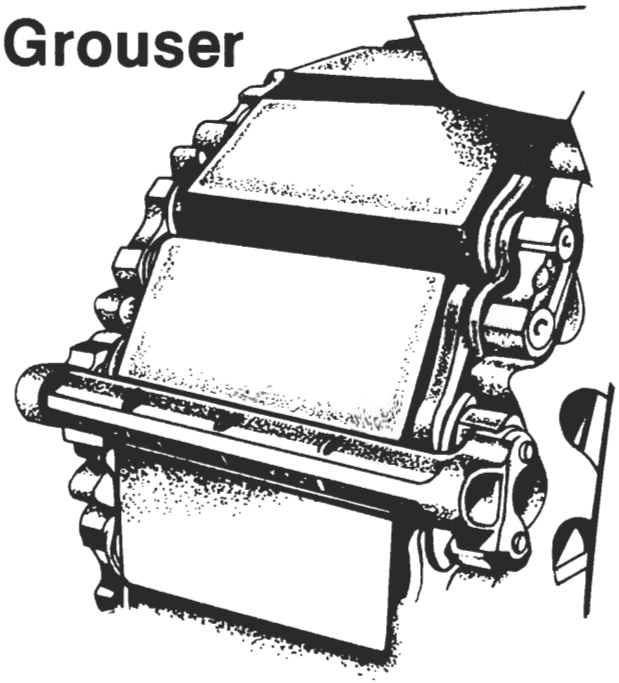
The two armored columns met around St. Lucien. Company B, in command of Capt. William Tuck and supported by a few 75mm GMC M3s, ordered his M3A1s across the field with two platoons in V formation and the other 500 yards to the rear. The French *Chars leger 1935 R* opened fire with their 37mm SA.18 guns, but did little damage. The more effective M6 37mm guns of the Stuarts tore the French tanks up, leaving 14 burning for the loss of one Stuart temporarily damaged and one sergeant wounded. These one-sided engagements were the first tank-vs-tank engagements of the U.S. Army in the ETO but they were no prediction of what was in store in the immediate future.

Following the armistice with the French, Col. Todd's and Col. Water's Stuart battalions were ferried to Tunisia along with one M3 Medium Tank Battalion, and they bore the brunt of the fighting there until the rest of the Division arrived with the remaining medium tank battalions. The first armored engagement of the Tunisian Campaign occurred on the evening of 25 November 1942 when a pair of *Semovente L40 da 47/32s* on a scouting patrol down the Chouiqui Pass were knocked out by tanks from the HQ section of 1st Bttn. 1st Arm. Rgt. The following day, the American tankers met German tanks for the first time. Col. Water's battalion was positioned at the entrance of the Chouiqui Pass when a formation of the 190th Panzer Battalion was spotted. The formation consisted of at least 3 PzKpfw IIIs with 50mm guns, 6 PzKpfw IV ausf F2s, some mounted infantry and some Italian vehicles in support. Major Siglin's Company A attacked the formation on its west flank, but badly outgunned, it lost half of its 12 M3A1s in a matter of minutes. While the Germans were distracted, Major Todd's Company B swung around from the rear and hit the German armor from the rear, knocking out 6 PzKpfw IVs and 1 PzKpfw III without loss. The rest of the German tanks retreated, exposing the truck borne infantry column which was decimated by Company A and B, of the 1st Battalion, 1st Armored Regiment.

Despite this relatively successful introduction to the Germans, the fighting in Tunisia continued unabated and the undergunned Stuarts took heavy losses. By Christmas, both battalions together were down to less than two dozen tanks from the more than one hundred with which they had started. The 37mm gun was inadequate in tank-vs-tank action against the PzKpfw IV and even the PzKpfw III was invulnerable at ranges of over 500 yards. By contrast, the armor of the Stuart was easily penetrated at ranges of much greater than 500 yards by either the long 50mm or long 75mm of the German tanks. The tankers recommended at least a 75mm gun, but after the conclusion of the campaign, the Division's light tank companies were re-equipped with the new M5 which still mounted the same 37mm gun.

(Above) A pair of Marine M3A1s guard one another along a road on Kwajalein Atoll in February 1944. (Below) A 4th Marine Tank Battalion M3A1 plows through the jungle on Makin Atoll in November 1943. These views nicely illustrate the new rounded engine deck of the welded hull M3A1. The vehicle below still carries the air trunk fitted to aid wading ashore during the initial assault. (US Army)

Rubber Block Track with Grouser



An M3A1 of a Marine Defense Battalion tows a Type 97 Chi-ha captured from the Japanese 7th Independent Tank Co. on Guadalcanal. The M3A1 is fitted with strips of air field metal matting for use in the event the vehicle gets stuck in the mud. This unit was stationed in New Caledonia at the time. This vehicle has the flame gun in the place of the hull MG, rather than strapped to it. (US Army)

M3A1 Flamethrowers

A closeup of the M1A1 flame gun fitted to the machine gun position of the M3A1. (US Army)

Escorted by a pair of M3 Lees, this lend-lease M3A1 is seen in Russian service, attacking north of Stalingrad, November 1942. A sufficient number of American-made vehicles reached Russia by way of Iran that some units on the southern front were completely equipped with U.S. equipment. This vehicle carries the name "Suvoroff" on the sponson and the slogan "Death to the Fascists" on the turret. The top point of a white-bordered red star is visible behind the SMG firing soldier. (Sovfoto)

A Replacement For The Stuart

The M3 light tank was based on technology originating with the 1933 T2. By 1941 its further developmental potential was quite limited. Its narrow width, dictated by Corps of Engineer rules referring to the narrow bridges, trestles and roads of the 1920s, severely limited the fitting of any gun larger than 37mm. Recognizing these restraints, the Armored Force in 1941 requested Ordnance to develop a wholly new type, which was given the pilot designation T7. Of the various pilot models built, the T7E2 seemed the most promising and in view of British recommendations to uparm the Stuart, a version was built using a 57mm gun. Trials went quite well. In fact they went too well. Had the uparmed T7E2 been accepted into service as a substitute for the M3 Stuart, the US Army would have had a thoroughly modern light tank design with the potential to be uparmed or uparmored even further. Instead, the Armored Force pushed the design much too far, insisting that it be armed with a 75mm gun and uparmored in order to provide a substitute for the M4 Sherman Medium Tank. There was no need for such a substitute, though there was a real need for a better light tank. The resulting Medium Tank M7 was inferior to the Sherman in its class and was cancelled. The Army would have to wait until 1944 before another new light tank was ready and in the meantime would have to make due with the M5 series.

The Army also designed a small lightweight tank for parachute operations designated M22 of which 830 were built. Armed with a 37mm gun, the tank proved too heavy to be successfully air portable. By the standards of 1944, the design was cramped, not entirely satisfactory and cumbersome to use, and only six saw action with the British 6th Airborne Division in the Rhine Crossing, March 1945. The remainder were used mainly for training.

The tiny M22 Locust airborne tank, which saw no combat service with the U.S. Army though the British did use a few in the Rhine crossings. The vehicle here is being used for training at APG in 1944. (US Army)

The ill-fated Medium Tank M7 currently preserved at the APG Tank Museum. (Author)

The Light Tanks

M5 and M5A1

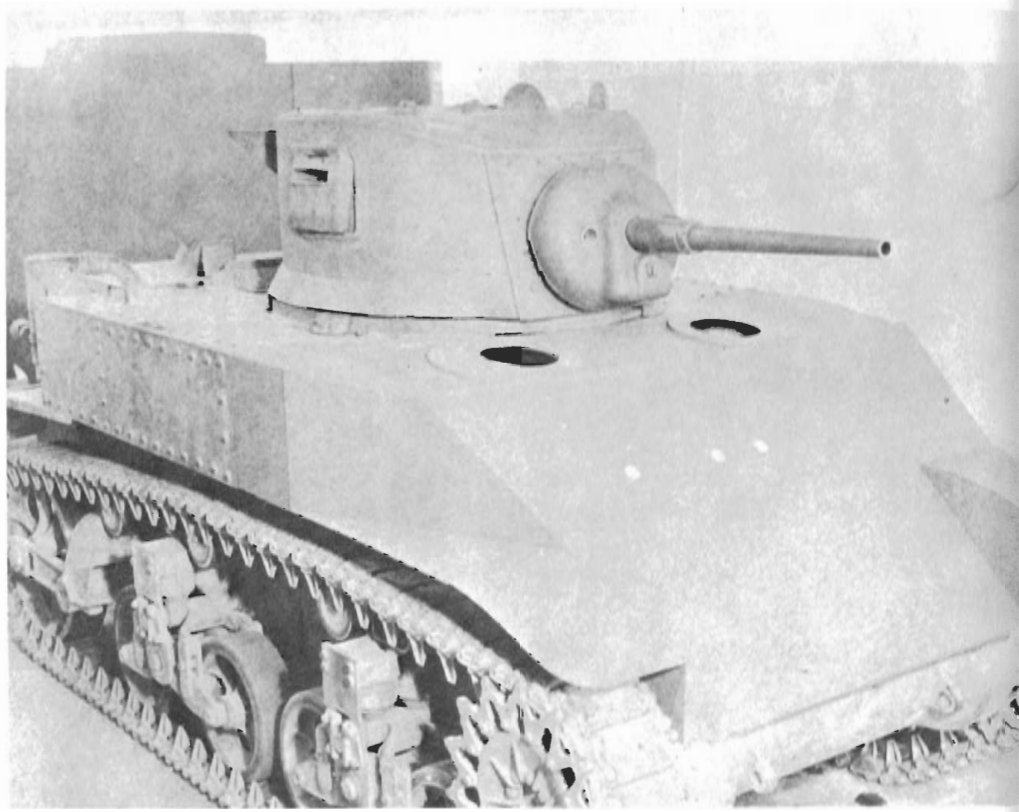
In July 1941, Ordnance was quite concerned that there might be an eventual shortage of Continental radials and authorized the search for alternate powerplants for the M3 Stuart. General Motors offered to develop a prototype using two Cadillac automobile engines with Hydro-matic transmission, designated M3E2. The vehicle was tested that summer at APG and revealed numerous improvements over the existing engines. While somewhat heavier, the new engine provided more power, was quieter and smoother running, there were large quantities of the engines available, and the automatic gear shifting would ease the task of the driver. An added advantage was that the power train assembly did not protrude as far into the fighting compartment which would allow a far superior turret basket assembly to be used. In October 1941, Ordnance approved production of the new tank as Light Tank M4.

In the meantime, Ordnance had been considering the design of a light tank with a fully welded homogenous armor hull, designated M3A1E1. The development of both these separate versions was redundant, and in November, both projects were merged. The resulting vehicle was given the designation Light Tank M5 to avoid confusion with the new Medium Tank M4 which was entering service. The pilot model was completed in April. Tests by the Armored Force in August lived up to their expectations. The M5 proved itself clearly superior to the M3 and M3A1 in most respects. A total of 2,074 M5s were produced before December 1942.

The new M5 was markedly different in appearance from the previous Stuarts, though its lineage was still clear. The suspension and turret were nearly identical to the M3A1 though stronger springs had been added in the rear idler arm assembly and grouser stowage was moved to the turret sides. Two of the four man crew rode in the turret, with the commander/loader to the right and the gunner to the left. The two other crewmen rode in the front with the driver to the left and the co-driver/machine gunner to the right. An alternate set of driving controls was provided for the co-driver. The M5 lessened the training time at the Armored Training Centers since the automotive clutch proved much easier for the average driver to master, and many mechanics were already familiar with the Cadillac engines from peacetime experience. The M5 was adopted as the standard light tank of the armored divisions, and aside from M3s still in use in training, the remainder were set aside for Lend-Lease.

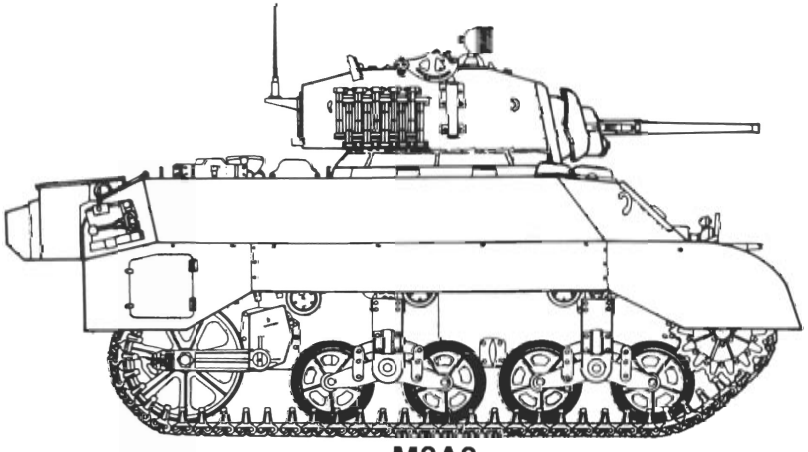
In spite of the obvious success of the M5, Ordnance still desired to produce light tanks with the Continental engine. Since the M5 was being built by Cadillac and Massey Harris, the American Car & Foundry factory was free for use. As a result, in April 1942, the Armored Force asked Ordnance to develop an M3 variant using the Continental which was up to the standards of the M5 in terms of hull design. The resulting vehicle, the M3A3, resembled the M5, but was without the noticeable bulged engine deck at the rear and had the sponson sides sloped to 20° in contrast to the M5's which were vertical. While the hull was undergoing redesign, the engineers set about to alter the turret to accommodate the radio set at the rear. An extension was added at the rear, the pistol ports were removed and the upper hatches were redesigned. The modifications also allowed the engineers to design an improved mount for the gun telescope, which was moved several inches upward, and the result was the Combination Gun Mount M44. The Light Tank M3A3 replaced the M3A1 on the assembly lines in January 1943. By the time production was completed in August 1943, 3,427 were built. In spite of the large numbers of M3A3s produced, it was the least significant version of the Stuart family from the American standpoint. None were used by American forces in combat due to the decision to stick with the M5/M5A1, and only a small number were used for training. The M3A3 was earmarked mainly for Lend-Lease and served extensively with the British, Commonwealth, French, Chinese, Polish and other Allied tank units.

The new turret fitted to the M3A3 was an obvious improvement over the earlier M3A1 type fitted to the M5. Subsequently, in November 1942, M5 chassis began to be fitted with the M3A3 style turret and the resulting vehicle was designated Light Tank M5A1. Eventually 6,810 M5A1s were built, making it numerically the most significant version of the Stuart family. Production ceased in favor of the M24 in June 1944. There were a number of modifications incorporated on the M5A1 as production continued. A belly escape hatch was added in the floor for emergency exit and a new more rugged drive sprocket was designed. A new pressed steel dish roadwheel eventually entered service and a ventilator was added between the drivers' hatches. Towards the end of the production run, vehicles were fitted with a shield around a new turret machine gun pintle mount and a "bustle box" for stowage was positioned on the hull rear, necessitating a change in tool stowage.

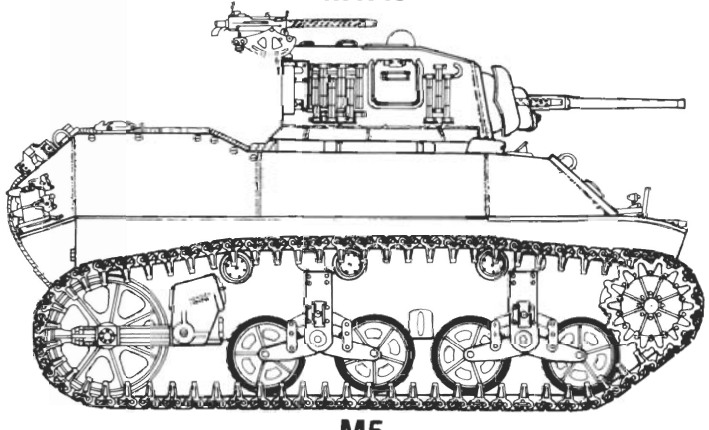


A wooden mock-up on an M3A1 hull for the M3A1E1 which was eventually merged with the M4 project, leading to the Light Tank M5. (National Archives)

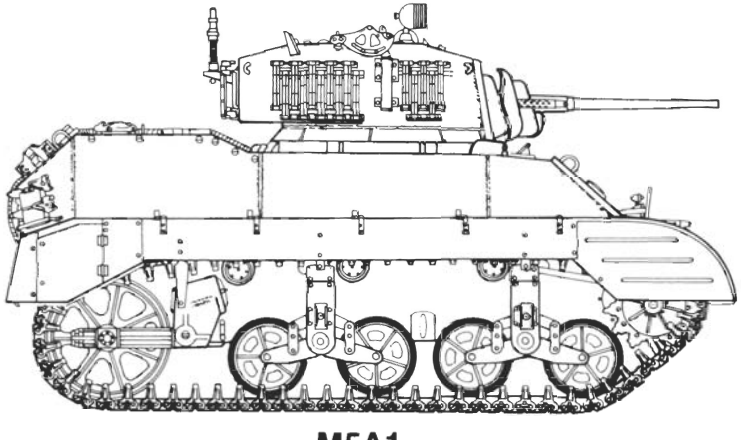
M5 Development



M3A3



M5



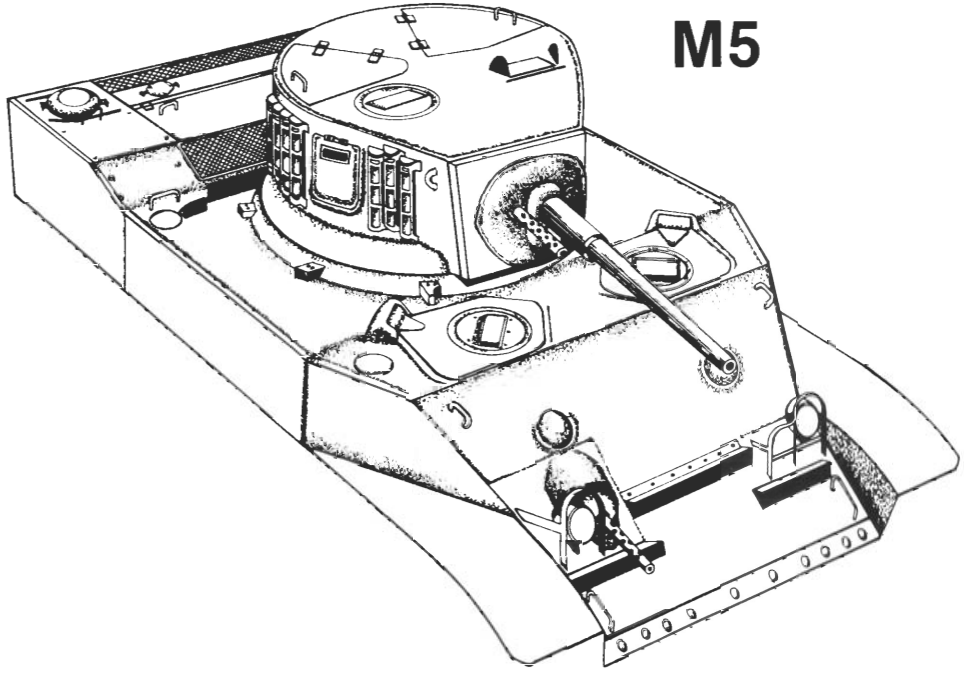
M5A1

A good shot of an M5 in training in Britain shows the old M3A1 turret fitted to the newly designed hull. 26 March 1943. (US Army)

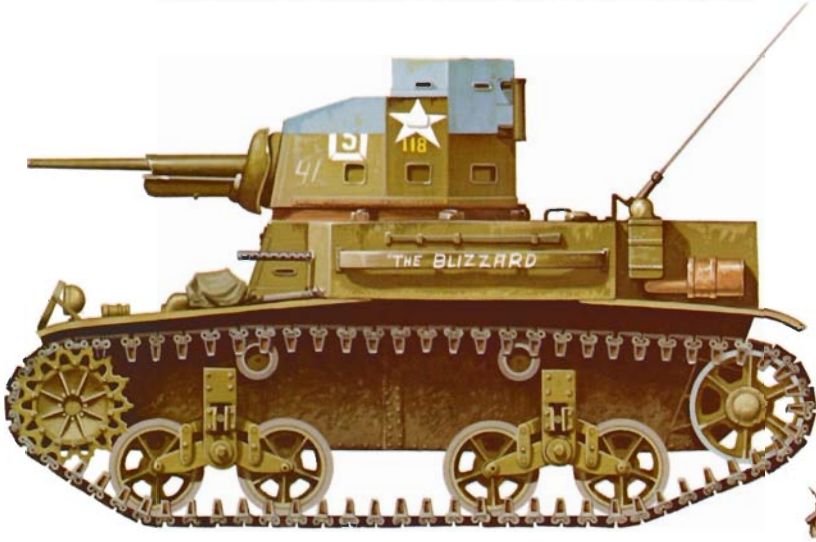
An M5 of the 2nd Armored Division is seen in training before being shipped to Casablanca. This was the first unit to be equipped with the new M5. "Queen-Lois" is marked overall in white. (US Army)

Three M5 Stuarts of the 102nd Cavalry Regt. seen training in Britain in 1943. The unit's emblem, a pugnacious bulldog, is featured on the hull side. (US Army)

A pair of M5s of the 102nd Cavalry in training. The M5 to the right is an early production machine without the driver's ventilator, while the vehicle to the left is a later production machine with it. (US Army)

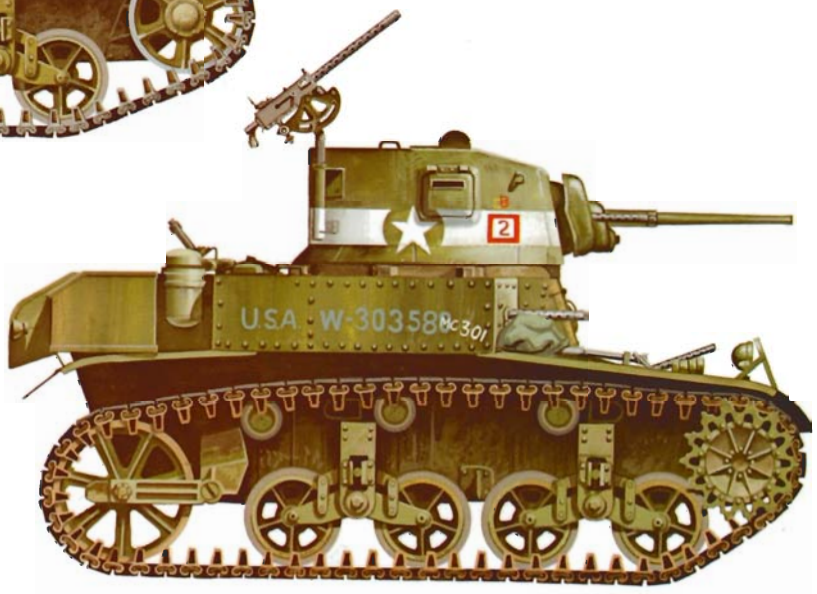


M5



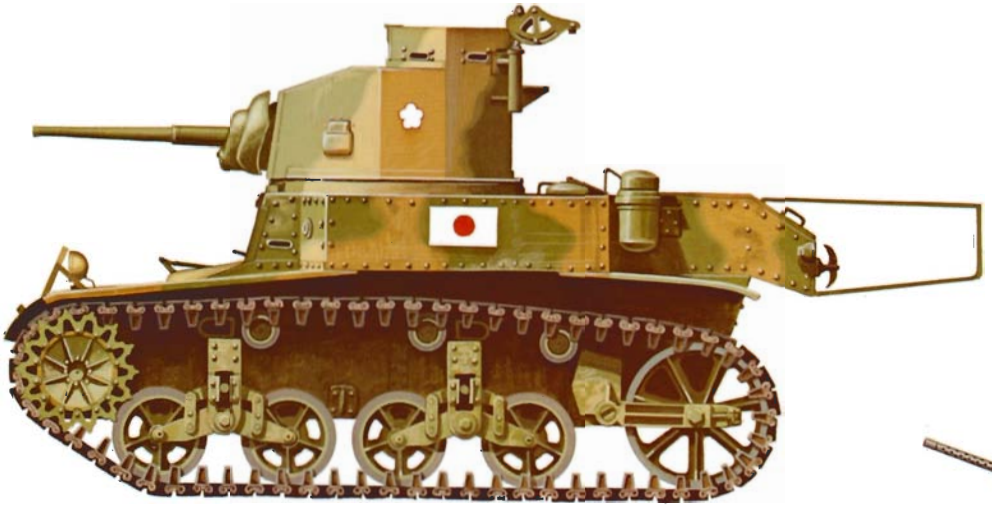
Infantry Insignia Plate

Light Tank M2A4 of Company A, 1st Marine Tank Battalion, Guadalcanal, September, 1942.

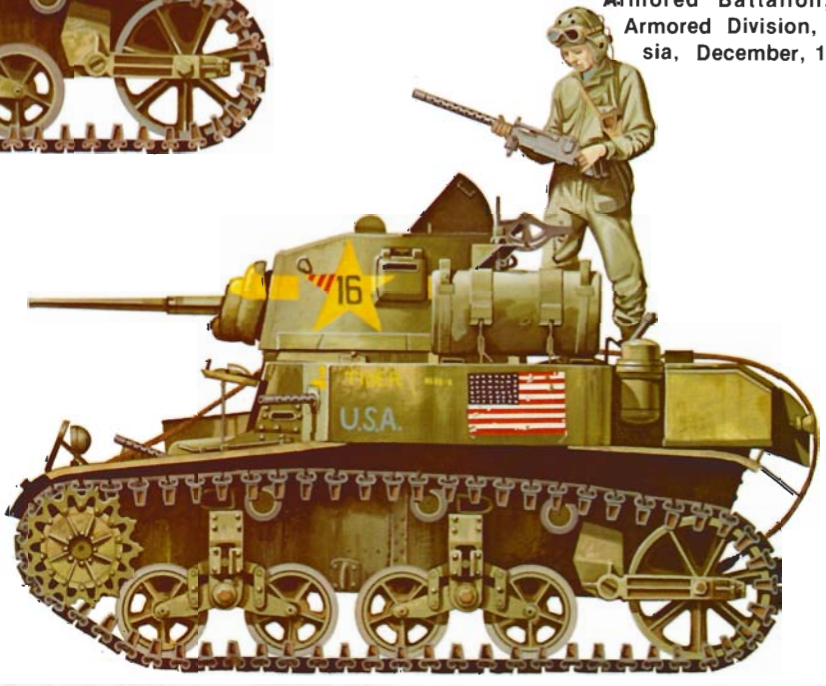


Light Tank M3A1 (Diesel) of Company C, 1st Marine Tank Battalion, Guadalcanal, December, 1942.

Light Tank M3 captured and used by the 3rd Chutai, 7th Sensha Rentai, Manila, May, 1943.

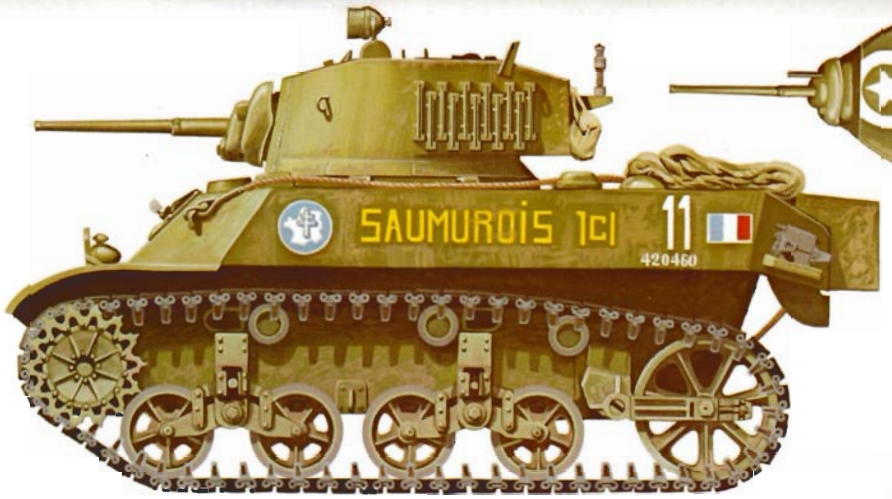


Light Tank M3A1, 3rd Platoon, Company C, 1st Armored Battalion, 1st Armored Division, Tunisia, December, 1942.



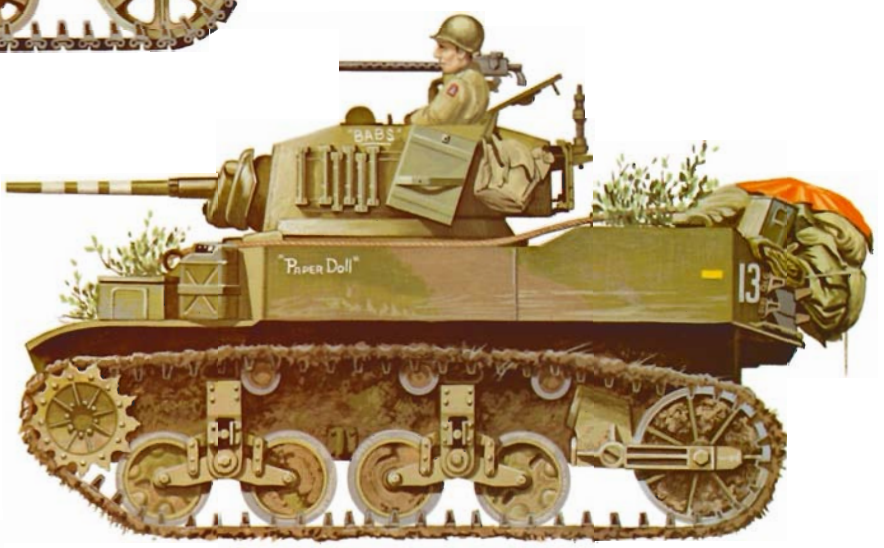
Company Insignia

Right Front Fender Marking



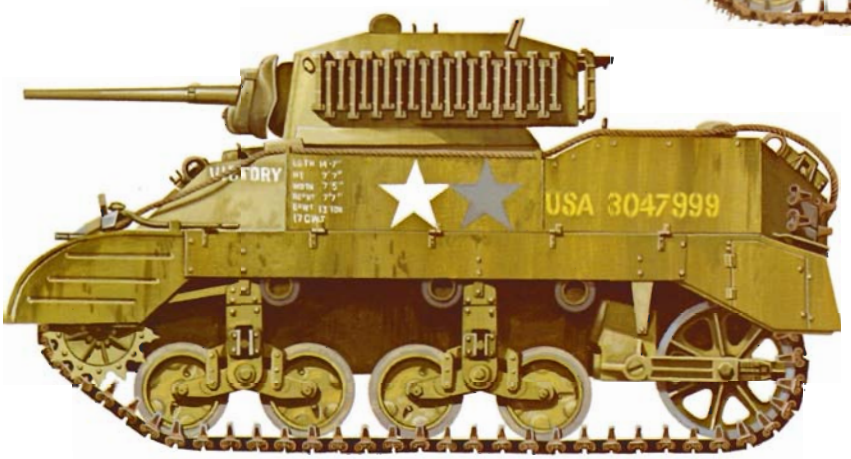
Turret Roof
with Air Recognition Star

Light Tank M3A3 of the French 12e Regiment de Chasseurs d'Afrique, 2e Division Blindée, Normandy, July, 1944.



Light Tank M5A1 of Company D, 13th Tank Battalion, 1st Armored Division, Bambiano, Italy, October, 1944.

Light Tank M5A1 in training in England, March, 1944.



"C" Ration Box

Bow Plate Marking

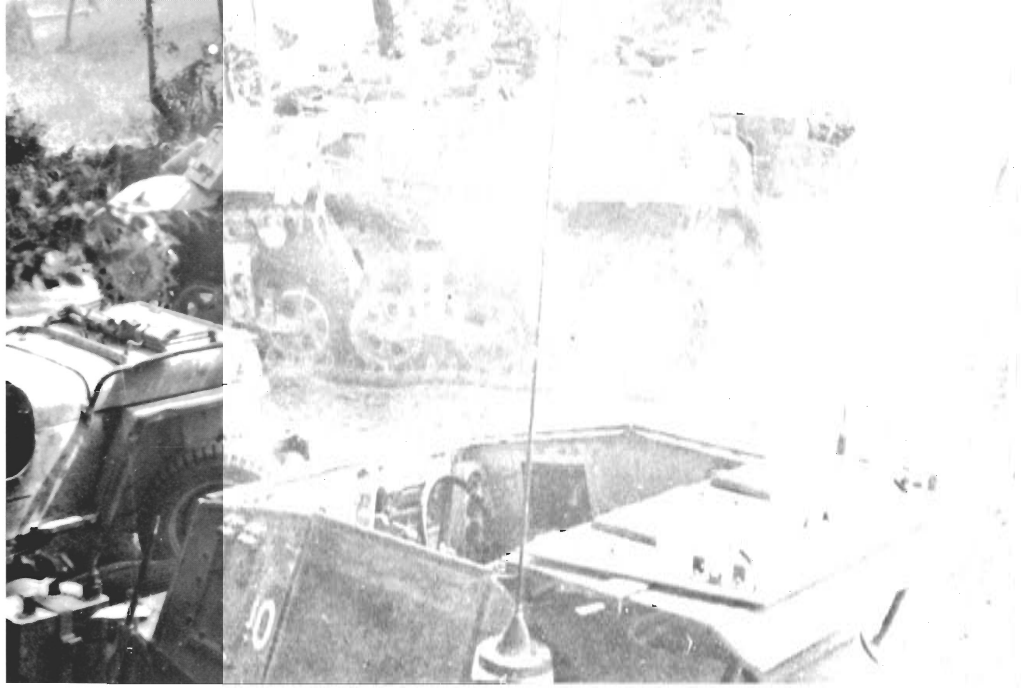
Light Tank M24 of Company D, 13th Armored Battalion, 1st Armored Division, Po River, Italy, April, 1945.

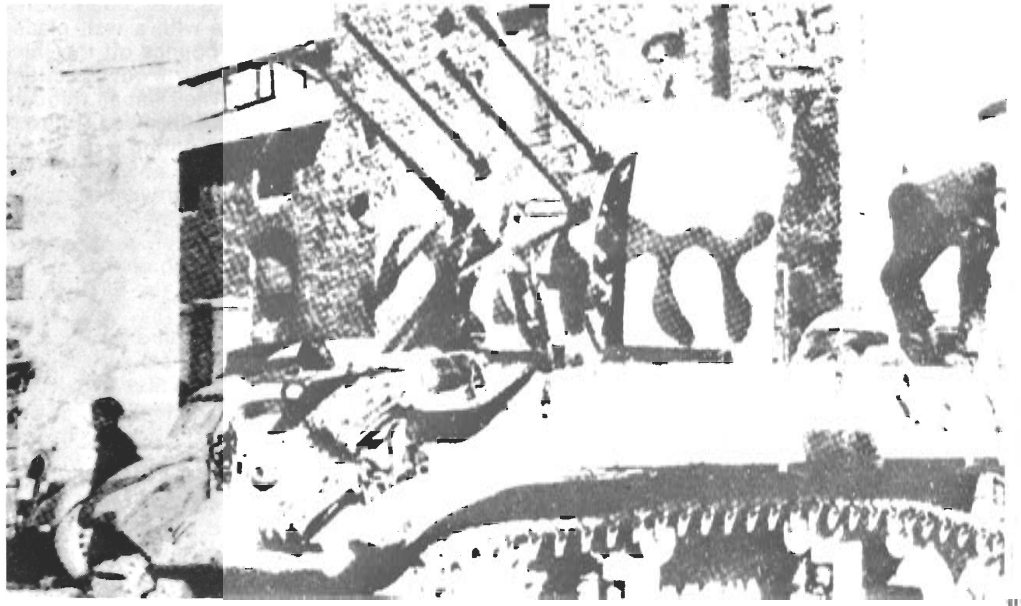
M3A3 in Combat

An M3A3 of the French 1e Spahis in the St. Louis area near the Swiss frontier in November 1944. Note that the rear bogie is fitted with late pressed steel wheels while the front bogie has the early spoked type. (US Army)

(Above Right) A Canadian recon unit uses a Stuart V Recce named "Ripper" to supplement its Daimler Scout Cars. This was a veteran M3A3 which had its turret removed and the interior gutted to make room for personnel. A splash rail has been added to protect the crew compartment and a .50 cal MG to add a little offensive punch. With better protection and cross-country ability than the Scout Cars, the Recce must have been a welcome addition to recon units. (Public Archives Canada)

An M3A3 of the Chinese Provisional Tank Group in Na Hsaw, Burma, February 1945. The Chinese Tank Group was supplied with M3A3s and M4A4s seeing action in the Burma theatre. These vehicles were later used in the Chinese Civil War. (US Army)





A rare shot of an M3A3 of the Yugoslavian 1 Tenkovski Brigada supporting Tito's guerillas in 1945. The British supplied the unit with 56 M3A3s of which one battery had the turrets removed and fitted with Flakvierling 38 quad 20mm AA guns as seen here and one battery was fitted with PAK 40 75mm AT guns. (Author)

The M5 and M5A1 In Combat

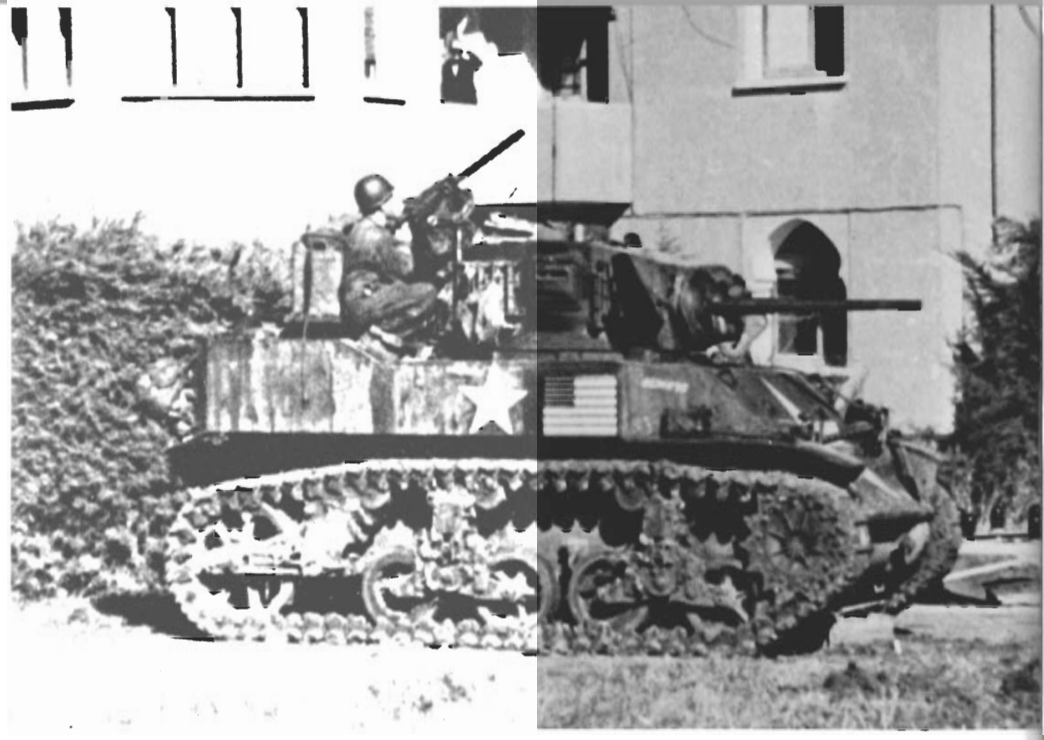
The M5 first entered action with the 2nd Armored Division during the amphibious invasion of Casablanca in French North Africa. There was little resistance and the 2nd Armored did not see heavy fighting as the 1st Armored Division did in Tunisia. The M5A1 appeared in service in North Africa shortly afterwards, at first in the HQ sections of tank destroyer units and eventually in light tank battalions as replacements for Stuarts lost in action. By the time of the invasion of Sicily, later in 1943, the M5A1 was becoming the standard light tank of the American armored divisions and the M5 was already being relegated to the training role. The M5 did see action in the Sicilian and Italian Campaigns and some even made it into the French and German Campaigns after battlefield attrition drained the reserves of M5A1s in England.

Following the Tunisian campaign, the Armored Divisions were reorganized as a result of the experiences there. The limitations of the light tanks were quite evident. In an effort to better support the light tanks, the light and medium tank battalions were broken up to make mixed battalions with 3 medium tank companies and one company of light tanks. Light tank strength dropped from 126 Stuarts per division to 51. During the campaigns in France and Germany the tactical use of light tanks changed as well. The M5A1 was armed with the same 37mm gun as the M2A4 of 1940. It was hopelessly inadequate when faced with any contemporary German tank. The Stuart could conceivably damage or disable a PzKpfw IV at point blank range with a well placed shot, but even at point blank the 37mm round would harmlessly bounce off the thick hide of a Tiger or Panther. As a result, field commanders kept the Stuarts out of actions where they might face German armor unaided by Shermans. Their most frequent combat role was to support the attacks of the division's mechanized infantry companies. A typical assignment would be to provide fire support during a half-track infantry attack and to help muscle them into the town or other objective while destroying strongpoints along the way. The M5A1s were also used to provide divisional flank security, rear area mop-ups, scouting and other tasks to free the Shermans for the central mission. Stuarts were used in the tank troops of the mechanized cavalry recon regiments for which they were well suited with their mobility and high speed.

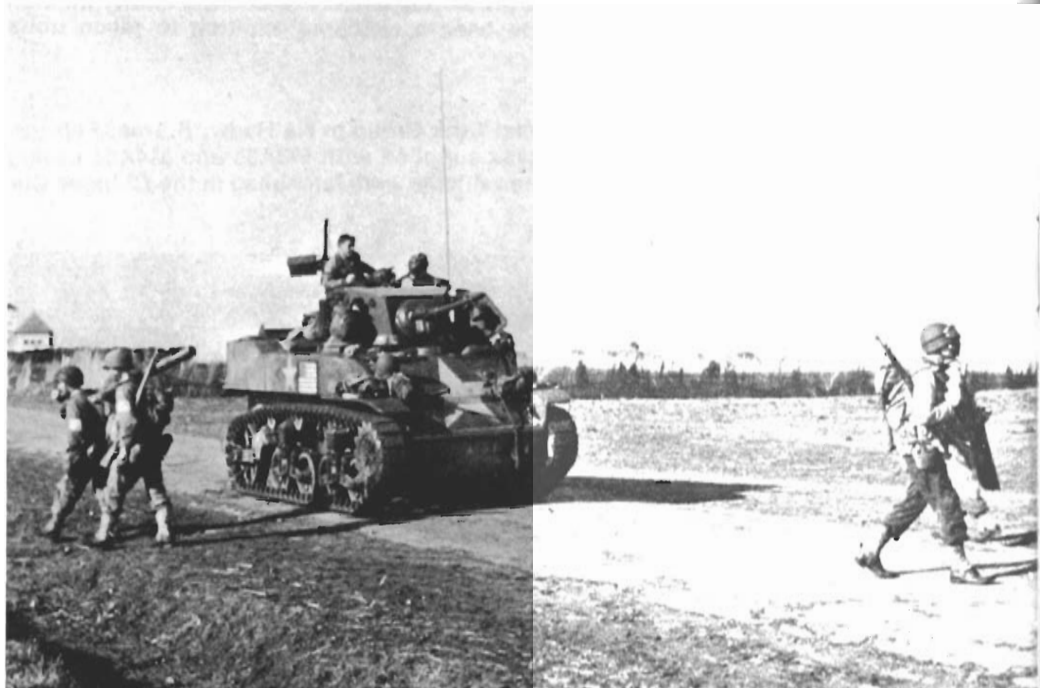
Though the Stuarts usually took a back seat to the Sherman in the ETO, in the Pacific they were frequently the only vehicle available. The M5A1 was first used in the Pacific by the 4th Tank Battalion during the Marine attack on Roi-Namur in February 1944 and by the same unit on Saipan later in the summer where they helped to repulse an attack by the **9th Sensha Rental.** During this action they destroyed a number of Type 97 Medium Chi-has and Shinhoto Chi-has. While the M5A1 was becoming obsolete by European standards, it was more than adequate in the Pacific owing to the very low priority the Japanese put on tank development. The Marine and Army light tank units in the Pacific used a number of different flamethrower devices to attack Japanese bunkers.

The Pacific area was the last major theatre of operations for the Stuart, being used by both sides in the Chinese Civil War in the late 1940s and by the French in Indo-China. There are still some Stuarts on active duty, the largest number being the M3A1s of the Mechanized Brigade of the Presidential Guard in Mexico.

A Ranger mortar team moves past an M5 of the 756th Independent Tank Battalion outside Casablanca. The prominent American markings were carried in the vain hope that the Vichy French would not fire on American troops. (National Archives)



An M5 of the 70th Independent Tank Battalion takes position by the weather station at the Casablanca airport. The airport was taken from the French on 9 November 1942 by the 70th in conjunction with the 2nd Armored Division (US Army)



A group of M5s of the 70th Independent Tank Battalion pass in review while President Roosevelt visited Morocco in the third week of January 1943. While the front star is painted in white, the hullsides carry the yellow star ordered for Operation Torch and dropped shortly afterward. (US Army)

A war-weary M5 of the 81st Recon, 1st Armored Division in Montaione, Italy, 20 July 1944. Most units had the M5A1 by this date. (US Army)

An M5 of the 899th Tank Destroyer Battalion moves up near Maknassy in Tunisia in April 1943. This is a definitive M5 with the half-donut bulge above the gun tube which preceded the M44 mount. (US Army)

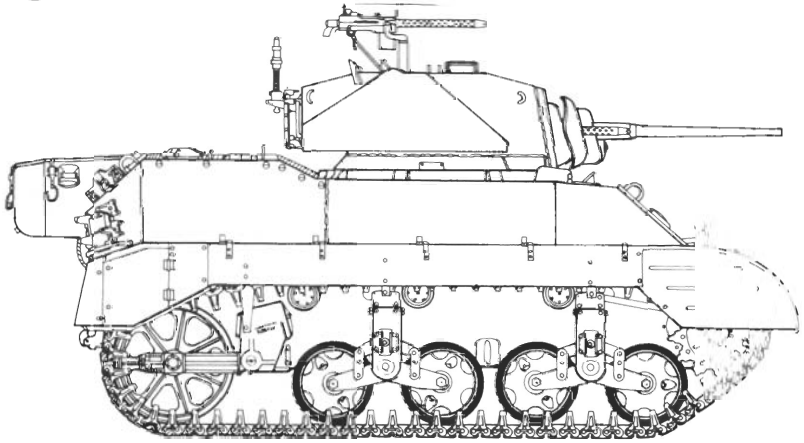
M5A1s of F Troop, 91st Recon, 5th Army pass through the rail station of Verona, Italy, in April 1945. Although the turret overhang is obscured, this is clearly an M5A1 as is evidenced by its M44 gun mount. (US Army)

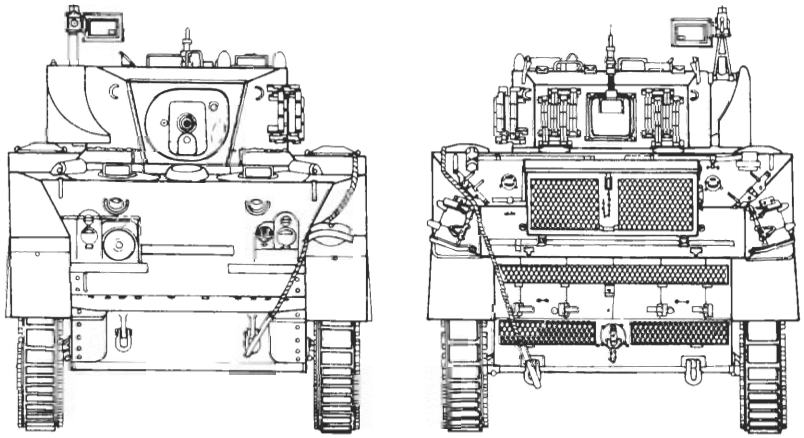
(Above Right) An M5A1 of the 1st Armored Division lies smoldering by the wayside as it is passed by an M8 Greyhound armored car on the way to Rome. (US Army)

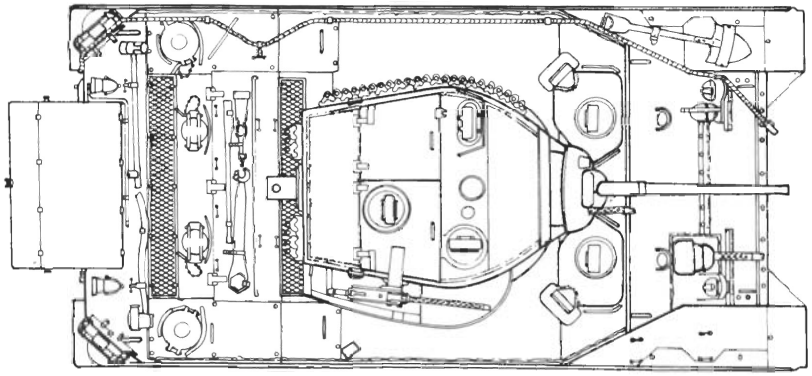
(Below Right) An M5A1 demonstrates the use of fascines for bridging anti-tank ditches. This vehicle, from the 1st Armored Division, carries the thick star surround marking which was ordered before the invasion of Sicily. (US Army)

An M5A1 of the 757th Tank Battalion serves as a map table as tank crews are briefed for the Mt. Porchia offensive in January 1944. (US Army)

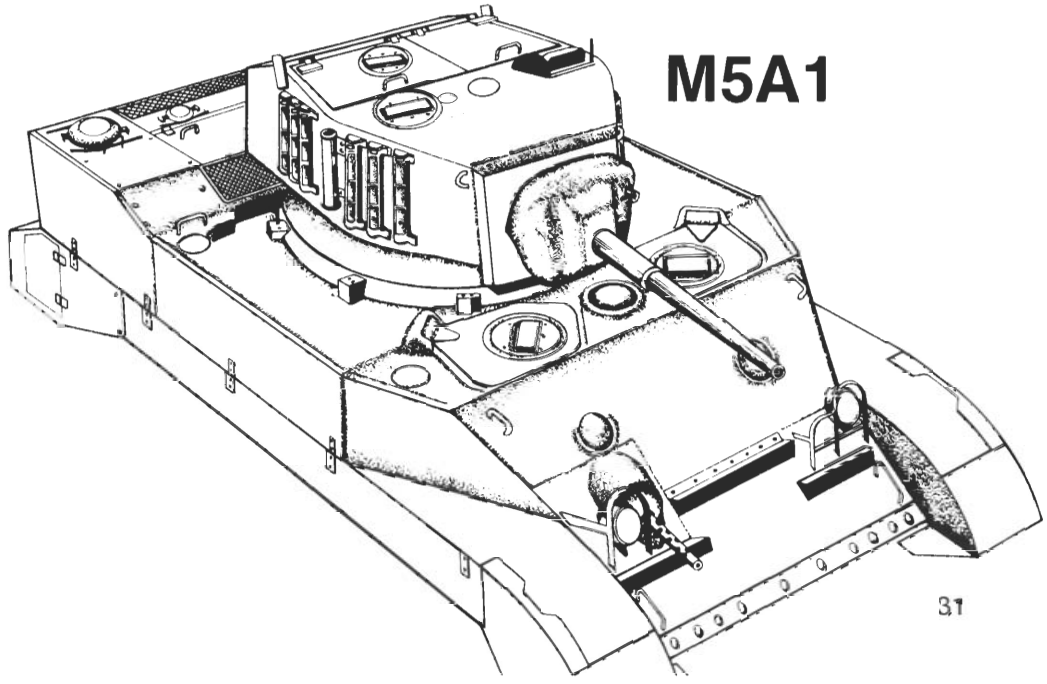
Light Tank M5A1





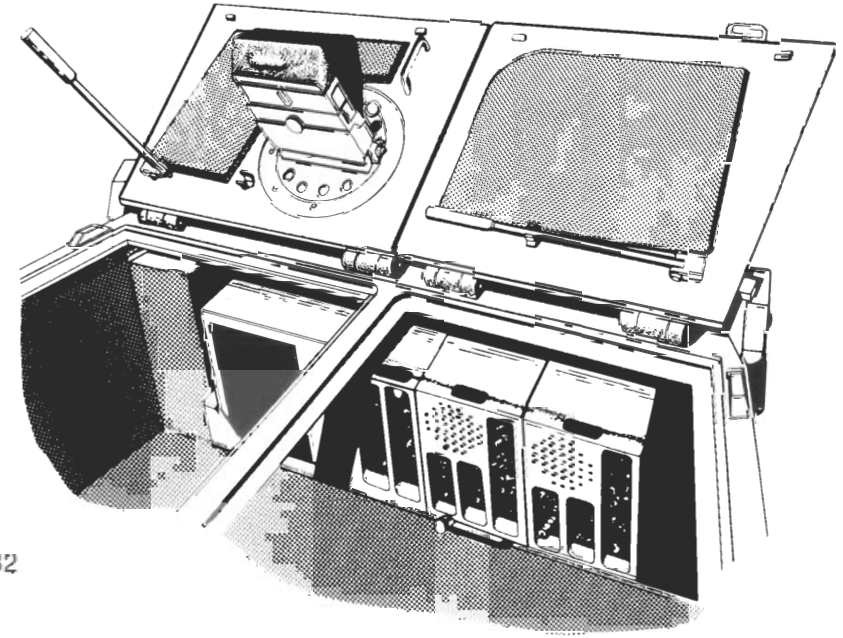


Variations of the Culin hedgerow cutters that were manufactured from old German beach obstructions are seen here. The device was designed to allow a tank to cut through the dense hedges in the Normandy farm country. Note also the well sand-bagged glacis plate which served to protect the M5A1 from German Panzerfaust and Panzerschreck rocket weapons. (US Army)



An excellent character study of an M5A1 in England for training. Barely noticeable behind the first white star on the hull side is the original regulation blue drab star that was usually overpainted by depots in England in white, then overpainted out in olive drab by troops in the field. (US Army)

SCR 508 Radio Installation



A heavily sandbagged M5A1 has just cut through a hedgerow with the help of the Culin device on the front. With thicker hedges, this often didn't work, sometimes sticking the tank fast. (US Army)

A pair of M5A1s speed down a dusty road in Normandy between two hedgerows with their Culin devices poking out in front. Note the large air recognition stars on the turret roof and the lack of any other stars. The lead tank has the tactical designation "B-21" painted large on the hull side, probably in yellow. (US Army)

"C12, Concrete", an M5A1 of a cavalry recon squadron, takes a sharp corner in St. Paul de Verney, 17 July 1944. This is a standard production M5A1 with the exposed M20 MG mount on the turret side. (US Army)

(Above Right) French civilians greet the arrival of the American troops as they pass through St. Amand, France in September 1944. This M5A1 is missing its hull MG. (US Army)

(Below Right) Infantry of the 114th Infantry Regiment board an M5A1 prior to their attack on Struth, November 1944. This M5A1 is fitted with metal cleat track instead of the usual rubber block track. The metal track added over half a ton to the vehicle's weight but gave better traction, especially on icy roads. Mud has been packed over the sandbags on the Stuart's glacis plate. (US Army)

A well camouflaged M5A1 passes through Coutances, France, on 30 July 1944. The circular plate visible on the hull front is yellow with black numerals, the number indicating the vehicle's weight in tons for bridging purposes. (US Army)

An M5A1 shepherds a mechanized infantry company in half-tracks on the fields near Buchet, France, 31 August 1944. (US Army)

The 37mm M6 Tank Gun

When introduced into combat in the fall of 1941, the Stuart's gun was adequate to penetrate the armor of most German tanks then in service in the desert (whose armor seldom exceeded 50mm), so long as they were engaged at ranges of about 500 yards. Unfortunately, the German 50mm gun could easily outrange the Stuart's 37mm and the addition of a further 30mm of applique armor on the PzKpfw III ausf F made it invunerable to frontal attack. The improved M51 round had a maximum point blank penetration of 63mm, but by 1942 the frontal armor of new German tanks entering service exceeded this. The generation of German tanks faced after Normandy presented an impossible challenge. The PzKpfw IV ausf H, with a maximum of 80mm frontal armor, was invulnerable to forward attack though its thinner sides and rear were theoretically vulnerable at close ranges. The 100mm + frontal armor of the Tiger and Panther was unapproachable and while, in theory, the Panther's 40-45mm hull side armor was penetrable, in practice this proved impossible. As a result, Stuarts were employed on missions tailored to the gun's limitations. In contrast, the 37mm M6 gun was more than adequate to deal with Japanese armor in the Pacific.

	Range	Penetration
Armor penetration of the 37mm M6 gun using the M51 AP round (30 degrees obliquity)	100 yards	63mm
	350 yards	58mm
	500 yards	55mm
	750 yards	51mm
	1000 yards	47mm
	1500 yards	40mm

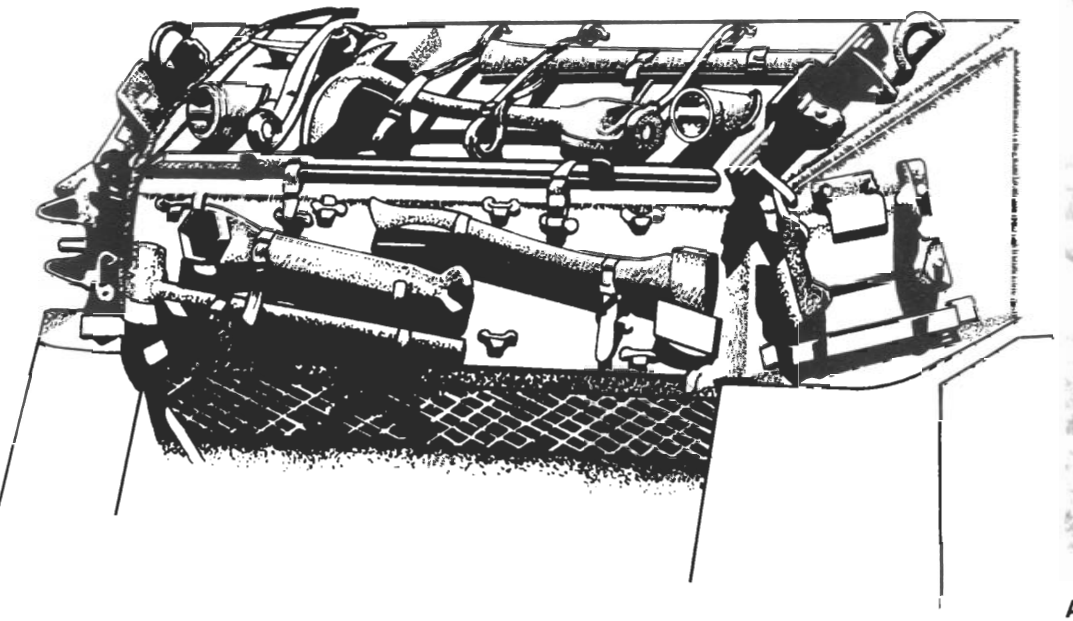
A well stowed M5A1 of the 17th Cavalry sits under camouflage nets near the German border in January 1945. It carries an improvised rear turret stowage rack as well as a Culin device, sandbags and the usual assortment of personal gear. (US Army)

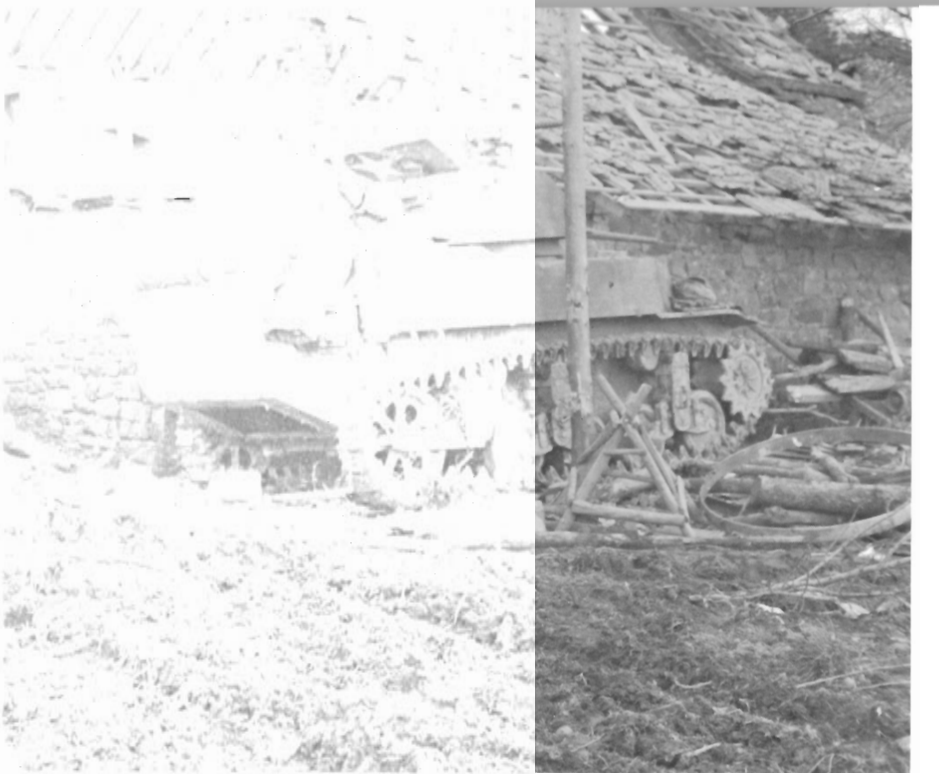
An M5A1 with a damaged second bogie truck is hauled aboard an M19 tank transporter near Torigny, France, August 1944. The left hand track has been piled on top of the turret. (US Army)

(Above) "Wasp", an M5A1, passes a jeep on its way through a destroyed town in Brittany, July 1944. The bright panel draped over the turret rear is a fluorescent orange celanese air identification strip which was standard equipment on all U.S. and British vehicles in the ETO. An information panel giving the vital statistics of the vehicle (length, height, etc.) has been stenciled on the hull side. (US Army)

(Below) "Shanty Irish", an M5A1 of the 12th Armored Division, pulls guard duty in a small town in France, February 1945. This is a late production machine with the rear bustle box. Note also that the exhaust deflector has been folded up. The stowage rails for grousers on the turret can be seen here because this vehicle, being equipped with steel cleat track, has no need of them. (US Army)

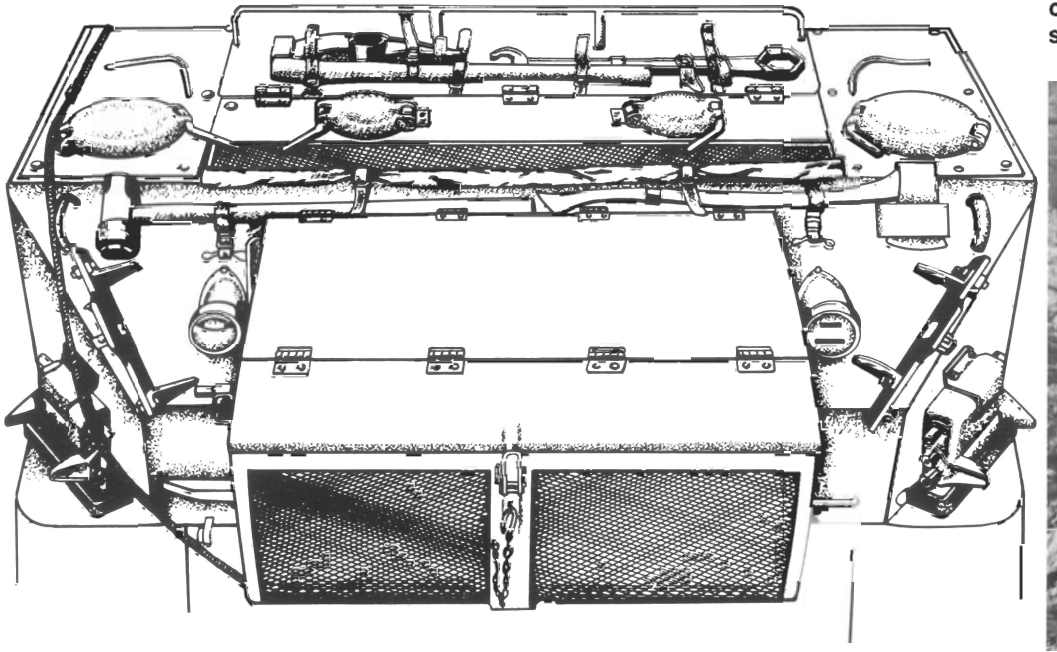
Early M5A1 Tool Stowage





An M5A1 of the 709th Tank Battalion halts near a damaged home in Klienhau, Germany. It still carries a rear wading trunk which was fitted to some tanks used in the Rhine River crossing operation. (US Army)

Late M5A1 Tool Stowage



Two troopers of the 84th Engineer Camouflage Battalion give an M5A1 a new coat of olive drab paint right over the mud, grime, sand bags and other stowage. The racks on the turret side are for additional sandbags. (US Army)

A column of late-production M5A1s, with the shield over the machine gun position, moves up in the Frankfurt area. Note that the tanks are fitted with duck-bill track extenders which give the vehicle a better ride over soft ground. (US Army)

Wearing a French mechanized trooper's helmet, a tanker of the 5th Armored Division blasts away at a strafing German plane in Viersen, Germany, 2 March 1945. The driver has fitted a detachable windshield in front of his station on the tank's left side. (US Army)

An M5A1 of the 4th Cavalry Group rolls into Angelsdorf, 28 February 1945. The crew has substituted a .50 machine gun for the usual .30 cal. Note the single old style spoked roadwheel. (US Army)

An antiquated M5 covers an infantry squad near Germersheim, Germany, in March 1945. A small number of M5s served in France and Germany when stocks of M5A1s ran low. (US Army)

A rain drenched M5A1 carries a wounded German prisoner back to Echtz, Germany, December 1944. Behind the Stuart is an M4A3 of the 3rd Armored Division. (US Army)

(Above Left) A tanker from the 3rd Armored Division blasts at snipers in the woods off the autobahn near Dessau, Germany, 17 April 1945. The attachment points for the dust skirts are still evident above the track run. (US Army)

(Below Left) "Brig", an M5A1, its track and first bogie blown off by a mine, is towed out of the mire by an M31 ARV.

An M5A1 of the 9th Recon, 9th Infantry Division crumbles a German road block on the way into Harze, 10 September 1944. (US Army)

"Flaming Fanny" and "Fire Buggy", a pair of M5A1s of the 13th Armored Group, have been fitted with turret mounted Satan flame throwers which were used during the Luzon campaign in January 1945. (US Army)

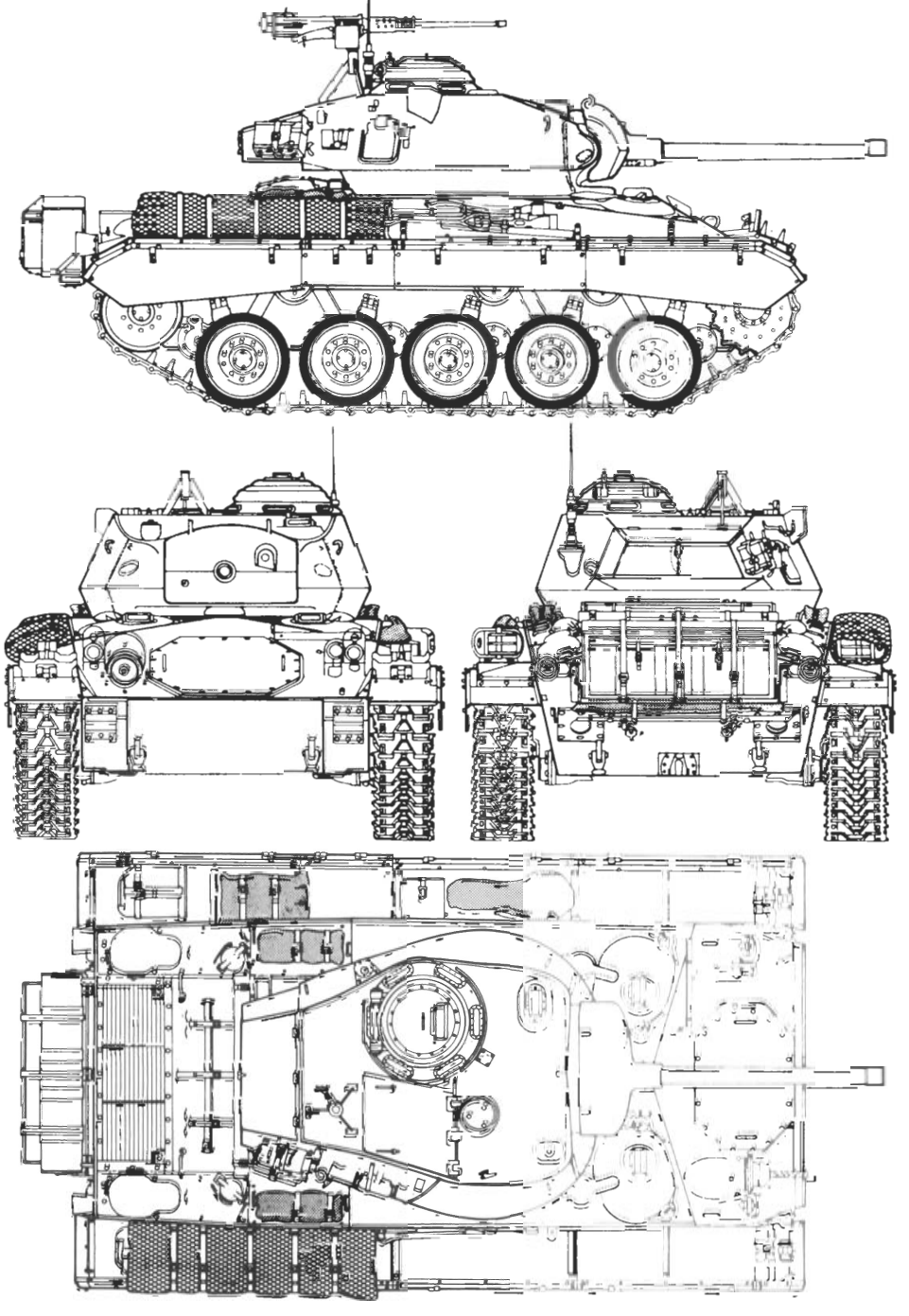
(Above Left) An M8 Howitzer Motor Carriage of the 106th Cavalry Recon Group shells German lines in February 1945. The M8 was the opened-top self-propelled gun derivative of the M5A1 mounting a 75mm Howitzer. (US Army)

An M5A1, with its turret removed for use as a command tank with the 1st Armored Division, passes an M31 and M32 ARV trying to pull a stalled Sherman fascine tank out of a river near Bresoia, Italy, 26 April 1945. Note the extremely thick surround to the hull side star and lightning bolt insignia. The meaning of the single small swastika on the dark panel is not clear. (US Army)

Stuart Variants

The Light Tank M24

Light Tank M24



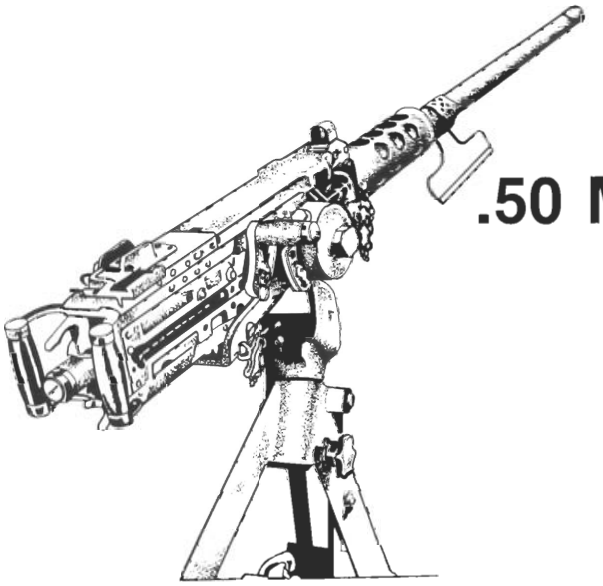
The experiences of the 1st Armored Division in Tunisia and the T7 light tank fiasco made the need for an upgunned light tank all too evident. Thought was given to fitting an M3 75mm gun directly into an M5A1 turret but there simply wasn't enough room nor was the vehicle turret ring large enough to accommodate a large turret. Attention turned to the M8 HMC which was based on the M5A1 hull, fitted with a 75mm howitzer. A modified M8 was tried with the 75mm tank gun. The combination worked, but the exposed turret roof and other factors eventually led to the demise of the project. Obviously a wholly new design was needed. Ordnance, in cooperation with Cadillac, went ahead with a pilot vehicle designated T24. Eventually they settled on using the existing M5A1 Stuart motors and power train and a modified suspension from an M18 GMC Hellcat tank destroyer. Design studies found that a 20 ton vehicle was necessary to adequately handle the M3 75mm gun. But since this was above the weight limit set by the Armored Force, another solution had to be found. The designers settled on the lightweight M5 75mm gun which had been developed for use on the B-25 Mitchell bomber. The first Cadillac prototypes arrived at APG in October 1943 for testing, trials continuing until spring 1944. Many minor improvements were incorporated before the tank was approved as the M24 in June 1944 and production was begun immediately.

The M24, eventually nicknamed "Chaffee" after Gen. Adna Chaffee, the "Father of the Armored Force", was undoubtedly the most brilliant light tank design of the Second World War. It was low, sleek, well armed and technically "state of the art". It began entering service with American troops in Europe in the winter of 1944, being found to be well suited to the light tank functions of mechanized infantry support and scouting. In the latter role, it was not so well armed or armored to tempt its crew to dig in and fight should they encounter an enemy tank. But if trapped, the situation was not so hopeless as with an M5A1.

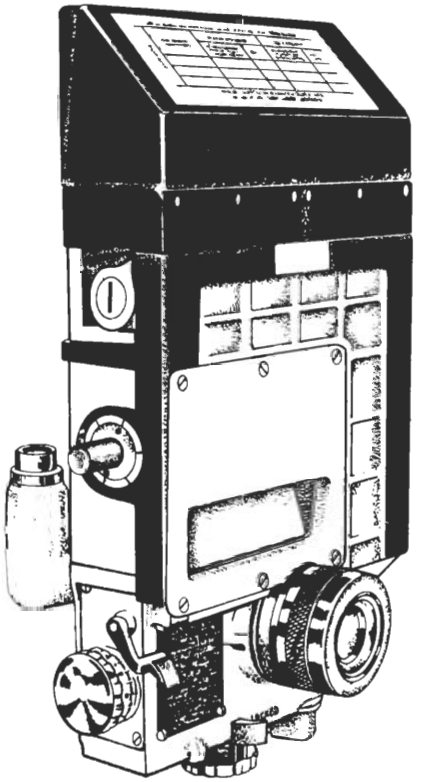
The M24's gun fired the same shell as the Sherman's, but because of the shorter barrel length, penetration was not as good (even the Sherman could not penetrate the frontal armor of the Tiger or Panther). The gun could fire useful HE and APHE rounds. For example, in early March 1945, some M24s of Troop F, 4th Cavalry Recon Squadron, stumbled onto two Tigers outside of Domagen, Germany. Reacting before the Germans could swing their clumsy manually driven turrets towards them, the Chaffees pumped several rounds into the Tigers which, while not penetrating, detonated internal stores which burned out the tanks. The heavier HE round fired by the M24 was likewise appreciated by the mechanized infantry, especially in the close fighting in German towns in the last months of the war. The 37mm high explosive round could only do a fraction of the damage of the 75mm round.

Following the war, the M5A1 was withdrawn from service, replaced by the M24. The M24, though not designed for tank-vs-tank action, was the only armor available in Korea during the opening phases of the Korean War in 1950 and its actions made the headlines. It was replaced after the war with the M41 but still serves with many NATO and allied countries, a fitting testimony to the quality of its design.

Crews mount up on their new M-24 Chaffees on the day after Christmas 1944 near Kornelmunster, Germany. The drivers of the two closest vehicles have fitted folding windshields in front of their hatches.

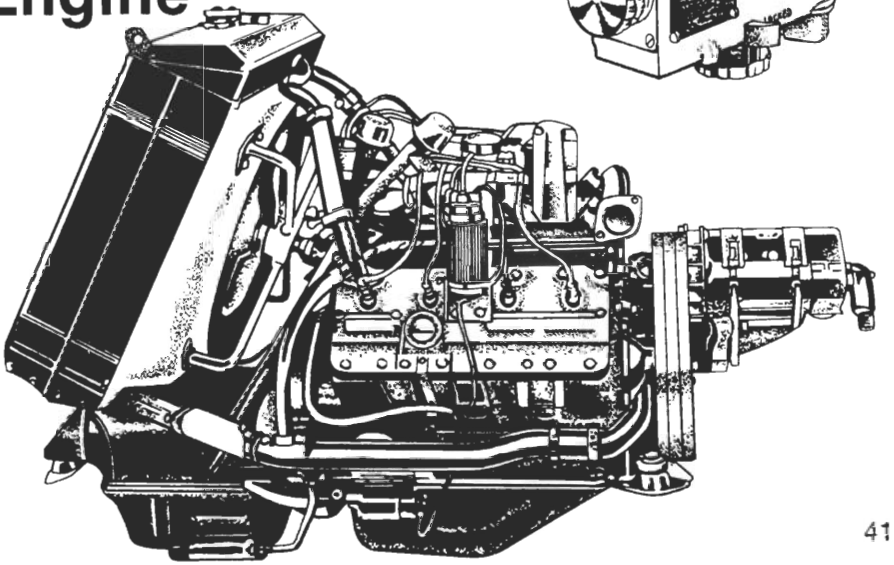


.50 Machine Gun



MI6 Periscope

Cadillac V-8 Engine



Two M24s of the 743rd Tank Battalion open fire along the autobahn near Eschweiler, Germany, February 1945. (US Army)

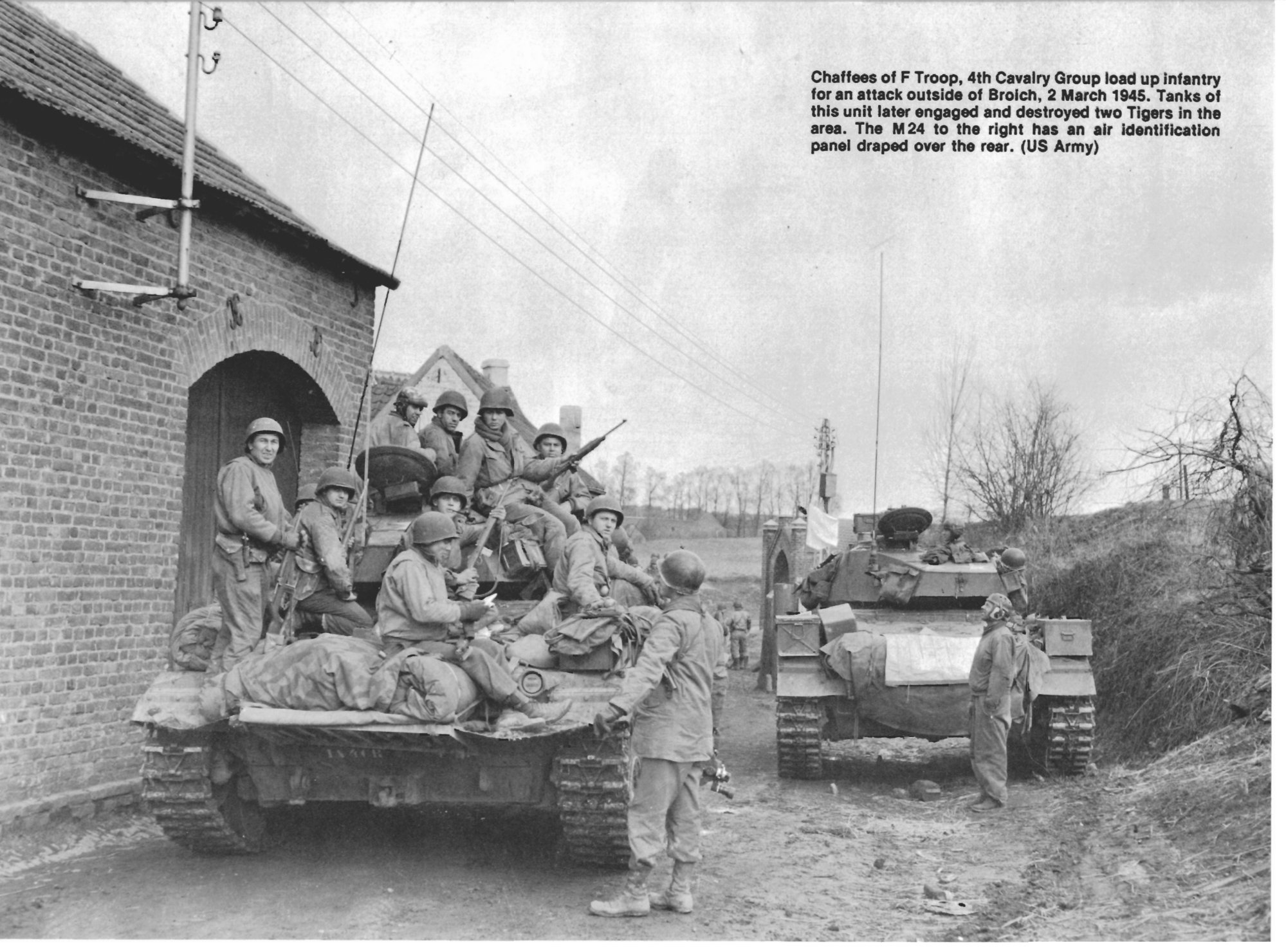
(Above Left) A new M24 patrols along the Belgian frontier in January 1945. Chaffees like these were originally slated strictly for the recon units of armored divisions, but often ended up in cavalry recon groups attached to infantry divisions. (US Army)

An M24 of the 117th Cavalry Recon Squadron test fires its gun in the St. Jean Saverne area of France, March 1945. The circled turret star is rare for an ETO vehicle. (US Army)

Unlike most previous American tanks, which were fitted with vertical volute suspension, the Chaffee was fitted with torsion bar suspension like German tanks. As a result, when first introduced into service in the winter of 1944-45, M24s were driven around to American units to acquaint them with the new design to hopefully prevent mistaken identity as is shown in the photo above. (US Army)

(Above Right) After the Battle of the Bulge, the 740th Tank Battalion of the 82nd Airborne Div. was reequipped with Chaffees like the snow camouflaged example here. (US Army)

A roughly camouflaged M24 of the 14th Cavalry Group, 18th Squadron, takes a breather in Petit Tiers, Belgium, February 1945. (US Army)

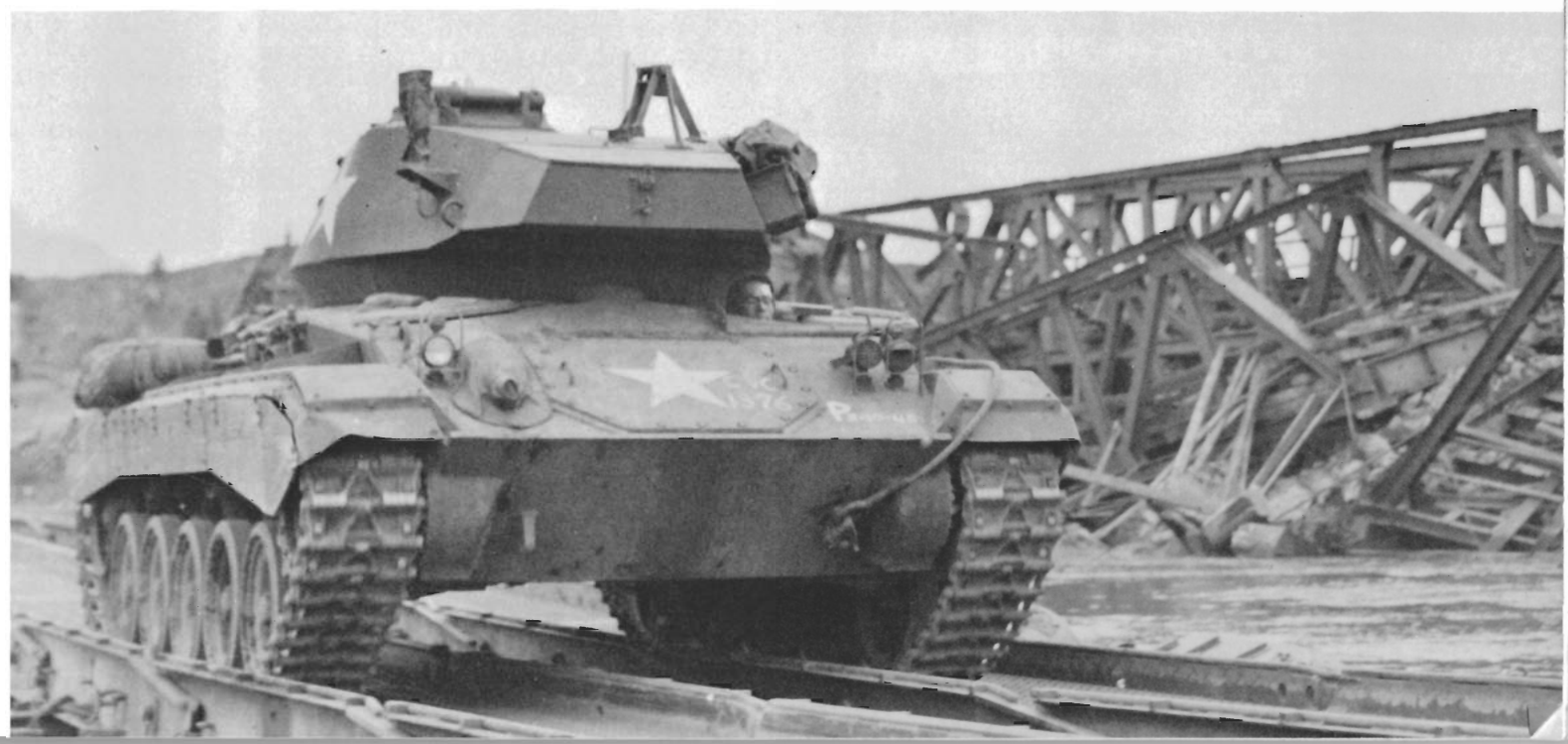


Chaffees of F Troop, 4th Cavalry Group load up infantry for an attack outside of Broich, 2 March 1945. Tanks of this unit later engaged and destroyed two Tigers in the area. The M24 to the right has an air identification panel draped over the rear. (US Army)

An M24 replete with sandbags supports the 47th Infantry Regiment in Bestwig, Germany, 9 April 1945. While an improvement over the M3-M5 series in protection, the M24's armor was not sufficient to allow it to stand up to Panthers or Tigers. (US Army)

(Above Right) An M-24 fires its roof smoke mortar near Kornelmunster, 26 December 1944. (US Army)

An M24 with its turret traversed to the rear passes over the Saar River into Trier on 13 March 1945. (US Army)



Troops of the 35th Infantry pass by an M24 of the 8th Armored Division after the capture of Rhineberg, 6 March 1945. (US Army)

(Above Left) An M24 of the 8th Armored Division lies disabled after an enemy shell set fire to its exterior stores outside of the town of Rhineberg, Germany, 6 March 1945. (US Army)

An M24 prepares to move out after having supported an attack by the 4th Cavalry Group on Dormagen, Germany, 5 March 1945. (US Army)

A group of Chaffees barrel down a forested road while supporting the Ninth Army drive outside Haulthausen, Germany, March 1945.

(Above Right) Infantry of the 120th Regiment pass a supporting M24 during their attacks on the 116th Panzer Division. The Chaffee is covered with the dirt left over from its burst sandbags. (US Army)

A pair of M24s of the 9th Armored Division stand watch over the exits from Karlsbad, Czechoslovakia, to prevent German troops from trying to avoid capture from advancing Soviet troops, 10 May 1945. (US Army)

A Chaffee with a prominent Allied star enters Munich, Germany, on 30 April 1945. (US Army)

(Above Right and Right) An M24 of Company D, 13th Armored Battalion, 1st Armored Division loads onto a ferry over the Po River in the Brede area, Italy, 24 April 1945. The twin hoops protect a "donkey sight" above the commander's periscope, used for indirect artillery fire. This M24, with typical combat stowage, was the first tank across the Po River. The 1st Armored Division was the only major unit to receive M24s in the Italian Theatre. (US Army)

American Light Tanks

in Retrospect

American tank development in World War Two often focused on quantity over quality. Tanks like the M5 were not introduced so much for the marginal improvements they offered over preceding light tanks but to more fully utilize America's considerable industrial potential. This proved to be something of a mixed blessing. On the one hand, America's massive munitions output was desperately needed by the Allies. It should be sufficient to note that American light tank production alone was nearly as great as the total wartime tank production of either Germany or Britain. Nevertheless, this fixation on quantity distracted American engineers from designs which would have had a better chance for survival in the ETO's technological arms race. The M24 design demonstrated their talent, but appeared too late in the war to be significant.

A major contributing factor to this problem was the contradictory strains in American tank doctrine during the war which often left Ordnance and the civil design teams in a conceptual vacuum. The Stuarts were lineal offshoots of both combat cars and infantry tanks, vehicle types having different tactical roles. Even after the Armored Force was created, there were ambiguities, brought about in part by the differing concepts of Army Ground Forces. There was no clear conception of the different roles intended for medium and light tanks. As a result, in Tunisia they were used in an identical fashion, which often proved unfortunate for the under gunned light tanks. On top of this, Army Ground Force doctrine held that tanks were not to be used except in emergency for tank-vs-tank action since this was the responsibility of Tank Destroyer Command. Yet to fulfill their functions of penetration, pursuit and exploitation, tanks will invariably be challenged in the tactical setting by enemy armor and often without tank destroyer support. Yet this bizarre splitting of responsibility needlessly obscured the search for adequate tank guns, the better anti-tank weapons being reserved for the TDs. This was a major factor in the undergunned state of American tanks in 1944.

As a result of these and other factors, when the M5A1 entered combat in the hedgerows of Normandy in 1944, it was dangerously close to being obsolete. The Stuart was incapable of facing any of the contemporary German tanks with any real chance of success and was extremely vulnerable to any number of German defensive weapons. American field commanders realized this and tailored the use of light tanks to suit their capabilities. Regardless of their technical or doctrinal shortcomings, light tanks were successfully employed throughout the war by capable field commanders and crews. While not as visible as their more famous counterpart, the Sherman, they nevertheless played a vital role in the armored thrusts across France and into Germany.

Tank Data

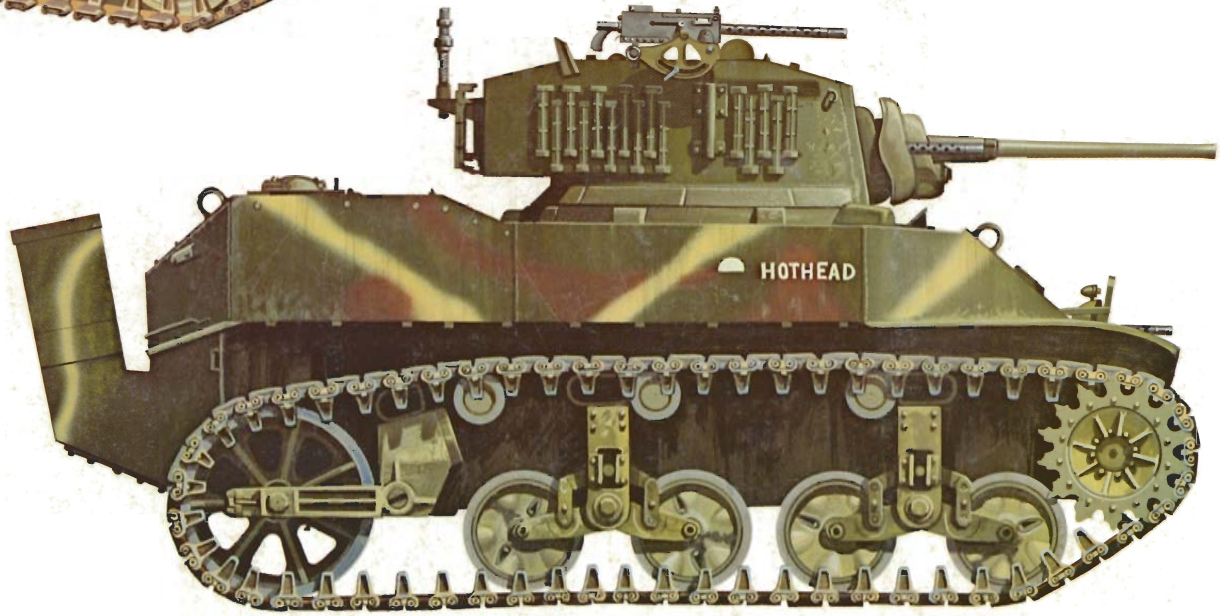
	M3 (Diesel)	M3A1	M5	M5A1	M24
Crew	4	4	4	4	4
Gross Weight (lb.)	27,400	28,500	33,000	33,807	38,750
Length	14'10.4"	14'10.4"	14'2.75"	15'10.5"	18'
Width	7'4"	7'4"	7'4.25"	7'6"	9'4"
Height	8'3"	7'6.5"	7'6.25"	7'10.5"	8'1"
Turret ring (in.)	46.75"	46.75"	46.75"	46.75"	60"
Ground Pressure (lb./in²)	10.47	10.56	12.4	12.5	10.7
Armor					
Hull-upper front	38mm	38mm	27mm	27mm	25mm
-lower front	45mm	45mm	63mm	63mm	25mm
-sides and rear	25mm	25mm	27mm	27mm	25mm
-top	10mm	10mm	13mm	13mm	13mm
-bottom	10mm	10mm	13mm	13mm	13mm
Turret-front	38mm	38mm	38mm	44mm	44mm
-sides	32mm	32mm	32mm	32mm	25mm
-top	17mm	13mm	13mm	13mm	13mm
Max. speed (mph)	36	36	36	36	35
Fuel capacity (gal.)	56	56	89	89	110
Crusing range	70 miles	70 miles	100 miles	100 miles	100 miles
Radio	SCR 245	SCR 508	SCR 508, 528, 538		
Engine	Guiberson T-1020-4	Continental W 670-9A	2 X Cadillac Series 42 V-8		
Horsepower (rpm)	210@2200 rpm	250@2400 rpm	220hp@4000 rpm		
Transmission	Synchromesh	Synchromesh	Hydra-matic		
Main Armament	37mm M6	37mm M6	37mm M6	37mm M6	75mm M5
Mount	M22	M23	M23	M44	
Secondary Armament	5x.30 cal.	3x.30 cal	3x.30 cal	3x.30 cal.	2x.30 cal. 1x.50 cal. 2" mortar
Ammunition					
Main	103	116	123	147	48
Secondary	8,270	6,400	6,250	6,500	3,750 (.30) 440 (.50) 14 (2")
Total produced	5,811 (All types)	4,410	2,074	6,810	4,195
Period produced	3/41-8/42	5/42-2/43	3/42-12/42	12/42-6/44	4/44-6/45

Light Tank M3 (Diesel) of the Desert Training Center, Indio, California, September, 1942.

Turret Left Side Marking

Alternate Turret Left Side Marking

Bow Plate Marking



Light Tank M5A1 of the 4th Marine Tank Battalion, Roi-Namur Atoll, 1 February 1944.

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